The Salmonid Enhancement Program

Fisheries and Environment Canada
Fisheries and Marine Service

Pêches et Environnement Canada
Service des pêches et de la mer

TABLE OF CONTENTS

FOREWORD

On May 30, 1977, the Honourable Roméo LeBlanc, Minister of Fisheries and the Environment, announced federal government approval of the first five-year phase of a salmon and sea-run trout enhancement program which will eventually result in a doubling of the annual catch of Canada's Pacific salmon. This program will create significant economic, social and resource benefits for Canadians.

From March, 1975, when the concept of a Salmonid Enhancement Program was first announced, until May 30, 1977, the Fisheries and Marine Service conducted an extensive series of studies and pilot projects directed towards the preparation of a comprehensive and geographically diverse enhancement package. This document is the culmination of the two-year study process.

The material herein is being provided with the intention of fostering a two-way exchange of information between the public and their government. Persons requiring further information or wishing to express their views are requested to write:

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THE SALMONID ENHANCEMENT PROGRAM

INTRODUCTION

This is an economic development program which will apply proven fish culture technology to increase the production of Canada's Pacific salmonid resource. This program will generate economic, social and environmental benefits through contribution to national income, regional development, employment, Indian well-being and environmental preservation goals of government.

BACKGROUND

1. At the Western Economic Opportunities Conference, 1973, Canada agreed to respond to opportunities in aquaculture and related fisheries projects; the salmonid enhancement program is a major contribution to fulfillment of this commitment.

2. On February 24, 1975, Cabinet gave approval to the development of a comprehensive plan for enhancement of salmonids for its consideration by March, 1977; authorized the Minister of State for Fisheries to enter into an agreement with the Province of British Columbia to implement co-operative planning; and authorized public announcement of government's intent to proceed with intensive planning of the enhancement program.

3. In December, 1975, Canada and the Province of British Columbia entered into a Memorandum of Understanding covering co-operative planning and programming leading to development of this comprehensive plan.

4. Under authority of this Memorandum of Understanding, a Steering Group comprised of Federal and Provincial officials was appointed to oversee the necessary co-operative planning and programming, which has resulted in this program. Studies of an economic, social, bio-engineering and environmental nature have been conducted at a cost of $6.0 million over two fiscal years. As well, intensive public consultations have taken place, resulting in a broad public understanding of the program concept and involvement in the planning process.

5. In 1975, Cabinet adopted an overall plan for managing and developing fisheries: "Policy for Canada's Commercial Fisheries"; the salmonid enhancement program is a key strategy in the implementation of this policy.

6. On May 30, 1977, the Minister of Fisheries and the Environment announced Cabinet approval of the first phase of the enhancement program. This first phase will be of a five year duration and cost approximately $150 million.

FACTORS

1. It is known that salmonid stocks on Canada's Pacific Coast were once capable of producing catches of 300 to 360 million pounds per year. By the beginning of the 1930's, major losses through environmental damage and overfishing had reduced production to about one half of this potential. Improved management practices have reduced this rate of decline but it is known that without any action to capture the initiative, the current salmon production of 145 million pounds annually will decline a further 20 to 30% by the year 2007.

2. Application of fish culture technology canstop this erosion of the resource base and conservatively, can also increase production of salmonids by at least 190 million pounds annually. One hundred and seventy separate enhancement projects have been identified, which along with a number of small stream improvements could provide the opportunity to produce this potential.

3. These enhancement techniques, many of which were pioneered and proven by Canada, include spawning channels, hatcheries, fishways, stream modification, rearing ponds and incubation boxes. A number of new and promising techniques such as lake and stream enrichment, Japanese style hatcheries and stock transplants are now in advanced development and ready for pilot application.

4. Extensive enhancement programs to increase the supply of salmon have been judged worthwhile and are in operation or planned in Washington, Oregon and Alaska as well as in Japan and the U.S.S.R. Canada, however, has some advantage in terms of generally having a high proportion of unspoiled natural streams, strong fishing and processing capacity, a traditional and strong export market position, and a leadership role in the broad application of fish culture technology.

5. Many of the salmonid enhancement proposals on the list of candidate projects could meet the economic criteria for public investment whether measured in terms of net national income benefits or in terms of favourable benefit-cost ratios or in terms of other social indicators such as employment, income levels of disadvantaged people (particularly those in coastal communities), or environmental quality.

6. There are no proprietary rights in sea fisheries and since salmonids are a commom property resource belonging to the people of Canada, only the Federal government can make the investment in enhancement and distribute the benefits accruing from this investment. The commercial industry and recreational fishermen would invest directly in this resource, if this were possible, in order to protect their present investment and to secure their future but can only do so through government initiative.

7. Relevant national income costs of salmonid enhancement include the construction and operating costs of enhancement facilities, the increased costs associated with the commercial harvesting and processing of additional fish, and the net costs to other water resource users.

8. Evaluation of benefits and costs shows that salmonid enhancement can provide significant net national income benefits.

9. Accordingly, salmonid enhancement projects have the potential for full cost recovery over time.

10. It has been determined that the commercial salmon fishing and processing industry does not require any appreciable quantities of additional capital and operating inputs in order to double its outputs. The economic rationale of the program, however, demonstrates that industry will have to be constrained from making unnecessary, new investment in response to the increased production, otherwise economic gains could be dissipated.

11. Studies to date, including the B.C. industry's own market assessments, conclude that demand is strong enough in Canada's main markets (United States, Western Europe and Japan) to absorb the increased salmon production without a reduction in real price. These studies show that, even with an assumed increase in production by other countries, a small increase in real price (0 to 1 percent per year) will occur over the next 30 years.

12. Investment by government in salmonid enhancement could greatly improve the efficiency of the industry, assuming that additional capital inputs will be disciplined.

13. In addition, investment by government in salmonid enhancement would raise the levels of economic activity in the provincial and national economies.

14. Moreover, a salmonid enhancement program could be planned in such a way as to be sensitive to the changing goals of government policy. It could be monitored and evaluated on an on-going basis and continued, stepped up, slowed down or discontinued according to the degree of success or failure exhibited.

15. If production were to be returned to its full potential, gross commercial fishing industry revenues could be increased by an estimated $274 million (in 1976 dollars) annually by the year 2007 (from $194 million to $468 million annually).

16. Such increases in gross annual revenues in the fishing and processing sectors, could result in a direct increase in income in the salmon industry of about $230 million and a further indirect increase in income from secondary impacts of at least the same order of magnitude. Because of the excess capacity existing in the industry, indirect economic impacts would be felt primarily by the consumer goods industries.

17. A large part of these additions to gross industry revenues would also favourably affect Canada's balance of payments as increased export earnings.

18. The total increase in employment from salmonid enhancement at the above scale could be in excess of 4.0 million man-days for Canada as a whole by the year 2007. About 45 percent of this would represent employment in British Columbia and the remainder would represent employment spread throughout the rest of Canada.

19. The British Columbia portion of this increased employment will have an important impact over the initial decade of implementation especially in coastal communities and on Indian reserves where new jobs would be created, existing jobs maintained and seasonal jobs extended as demonstrated by co-operative pilot and planning programs with Canada Manpower "Community Employment Strategy" and "Canada Works Programs".

20. There are about one quarter of a million salt water anglers and an additional 100,000 freshwater anglers fishing migratory salmonids in British Columbia. These numbers are growing at more than double the general growth rate in population, with higher disposable income and with increasing leisure time. Salmonid enhancement would be necessary to maintain the quality of the recreational fishing experience in light of this projected demand.

21. As well as benefits accruing directly to Canadian anglers, the recreational fishing industry could benefit significantly through the expenditures of growing numbers of Canadian and non-Canadian anglers.

22. In addition to cost recovery potential in the commercial salmon industry, there is also potential for cost recovery from salt water anglers.

23. Income and employment multipliers associated with salmonid enhancement will have the greatest overall impact in the more populated areas of British Columbia and Canada; nevertheless, the direct income and stabilization of employment impacts on remote coastal communities in British Columbia could be substantial in relation to the size of their economic base.

24. Salmonid enhancement will contribute to the well-being of Native Indian people through two principal types of benefits:

    i) those associated with the incremental production of fish; additional fishing income, food fishing, shoreworker income and new employment opportunities.

    ii) those associated with Native Indian involvement and employment at specific enhancement projects.

25. Salmonid enhancement presents a unique opportunity for a large untapped source of help from conservation-minded British Columbians to join with their governments in a creative restoration activity. The romantic appeal of salmon draws people into voluntary participation in program planning and active involvement in small stream improvement and protection. Besides this direct input, involvement provides an information and education function that leads to public acceptance of government's goals for fisheries, an understanding of fisheries regulations and an awareness of environmental requirements.

26. While the overall impact of the program is a major contribution to environmental improvement, there will be some projects that require environmental modification. Each of these projects will be subject to review under the federal "Environmental Assessment and Review Process". Where required, impact studies will be carried out and reports will be submitted in the same manner as that of any other development proponent using federal funds or federal lands.

THE PROGRAM: A STAGED MULTIPLE OBJECTIVE PLAN

The Salmonid Enhancement Program is a multiple objective program which can be staged in two phases. The long-term goal of this plan is to increase salmonid production by up to 190 million pounds per year.

Phase I, the first five years, has the objective of producing an increase of about 50 million pounds per year in the supply of salmonids through application of a judicious mix of low, intermediate and high technology. This staged work will be done in a manner which would contribute not only to government's national income goals but also to regional development, native Indian well-being, employment and environmental goals. By the end of Phase I the program should be capable of being regulated with sufficient confidence that directed enhancement activity will produce predicted and desired economic and social results, that is, salmonid enhancement could be used by government as a regional economic generator and development tool.

Phase II, beyond five years, will have variable annual salmon production targets based on attainment of government's current economic and social objectives. The annual rate of investment therefore will vary in accordance with these targets. Attainment of the long-term goal of increasing annual production by up to 190 million pounds would be constrained only by the economic soundness of the investment and by government's willingness to invest.

CONCLUSIONS

1. The basic evidence is now available to ensure that an implementation decision on salmonid enhancement can be made on sound economic, biological, engineering and environmental grounds.

2. The planning stage and the relevant studies have identified a program direction, a range of viable candidate projects and clear alternatives for implementation which, if pursued now, can result in real and demonstrable net economic benefits for Canada.

3. Implementation of a staged multiple objective program would require an investment of approximately $150.0 million for the initial 5-year phase (Phase I); investment during Phase II (years 6-15) would be fully assessable and controllable and based on demonstrated performance in terms of increased salmonid production, on economic benefit potential, and ability to achieve other government goals.

4. Real economic benefits would accrue to the nation from implementation of salmonid enhancement through the program's direct impacts on the entire Pacific coast commercial salmon fishing industry; from the expansion of the salmonid recreational fishery and associated industry; from the impact on regional development in British Columbia; from the impact on employment; and, from the impact on native Indian well-being.

5. The program has the significant additional feature that it can be evaluated regularly and adjusted financially over time to control or regulate the rate of investment to meet specific economic and social targets.

6. Evaluation of the economic benefits and costs of a well-balanced flexible enhancement program reveals clearly the potential for recovery of the costs of government investment in the program.

7. Only government can make the investment in salmonid enhancement since salmonids are a common property resource owned by the people of Canada. Further delay in implementation of an enhancement program will seriously jeopardize this economic development opportunity and could result in future requirements for substantial infusions of government funds to preserve an industry which will be confronted with serious economic dislocation.

The following sections expand on specific aspects of the program (proposal). The sections are:

1. **Description of the Proposed Salmonid Enhancement Program.**

   Provides background considerations along with a description of the program components, their activities and the proposed five-year financial flow for each.

2. **The Technical Rationale for Salmonid Enhancement.**

   Describes the history, the present status and the future prospects of the salmon resource; outlines the technology and the environmental capacity available for enhancement; the criteria for project selection and program optimization; and, demonstrates the proposed flow of the program.

3. **The Economic Rationale for Salmonid Enhancement.**

   Describes the methodology for evaluating benefit costs of the program under a five account system to reflect multi-dimensional goals of government; analyzes sample projects; outlines socio-economic impacts and examines specific policy issues such as; economic rent generation and cost recovery, fleet size, processing capacity and resource use interactions.

4. **Federal Provincial Relations in the Salmonid Enhancement Program.**

   Outlines Canada's and B.C.'s fisheries jurisdiction; the implications of the program to provincial fisheries management and research and to management of other resources; describes the co-operation of provincial staff during the planning phase; examines the need for and the possible types of federal provincial agreements.

5. **Public Participation in the Salmonid Enhancement Program.**

   Describes the objectives of this program along with the plan for achievement; the advisory inputs from both province-wide and local groups are outlined along with a range of activities planned for public involvement in the program. An attachment discusses the results of the test program already completed.

1. DESCRIPTION OF THE PROPOSED SALMONID ENHANCEMENT PROGRAM

I INTRODUCTION

This proposal to develop Canada's Pacific salmonid resource is the culmination of three decades of preparatory work. The required degree of certainty has been reached and the salmon resource can now be enhanced on the basis of a profitable government venture. To maximize the net benefits, it is important not only to begin immediately but also to design the program at a scale, rate and breadth that will ensure the best output over the long term for the least cost. Since potential benefits from salmon production are wide ranging, it is important to ensure that the program provides the capability of delivering a mix of outputs that responds to changing needs over time. For these reasons, the program design reflects the considerations of timing, scale, breadth and flexibility.

The need for an immediate start stems primarily from the fact that British Columbia's streams cannot continue to be protected for the production of salmonids on the argument of their potential value for fish production if the government is not willing to make a commitment to actually develop this productive potential. While British Columbia still contains many unspoiled watersheds with salmonid stocks that are still strong and diverse enough to provide a good enhancement base, the pressure from alternative uses of these rivers has intensified. The salmonid enhancement program expresses a federal commitment to manage this resource in the future to achieve its best use for the people of Canada.

Commitment to enhance the salmonid resource has to be made above a certain threshold scale. In the first place, a minimum scale is required in order to effect an economic program. Also, an integral part of this proposal would be a policy to recover government's investment costs from those who in future would benefit directly from the program. Without a commitment reflected in a scale of development which could create clearly distinguishable increases in the benefit flow, cost recovery would be impractical. Secondly, a minimum level of commitment is required early in the program if the diversity of the resource base is to be maintained. This resource base diversity is perhaps a more important indicator of the health of the resource than total catch.

The scale of the S.E.P. proposal also has a geographical dimension. The program is not a set of isolated production facilities. Rather, all of the major watersheds of Canada's Pacific Coast ultimately will be involved to some degree, with all the implications for how attendant lands will be developed in the future. The program also reaches into all the coastal communities in British Columbia and far inland into communities which border on the salmon's migration routes. Finally, the implications of the program stretch far out into the ocean pastures and involve complex questions of international fisheries management.

Behind this extensive proposal is a wide range of proven technology, from the very simple to the highly sophisticated. The simple act of removing rocks or logging debris from a streambed, for example, can greatly improve access for migrating fish to spawning grounds and give tremendous returns for very modest investments. At the other end of the scale there are many complex technologies which combine the fish factory and the biological laboratory. In a concentrated and sustained effort implied by the S.E.P. proposal, many new technological breakthroughs should be expected, with their attendant impacts on future benefits and costs.

In summary, it is known that, conservatively, it is technically feasible and biologically possible to increase salmonid production by approximately 190 million pounds per year. Investment by government to achieve this level of production could be economically sound. The S.E.P. proposal represents a commitment to develop this capacity. The ultimate target of this program is no less than to use the resource base as fully and effectively as possible, only constrained by physical limitation and economic justification.

II DESCRIPTION OF PHASE I

The staged multiple objective salmonid enhancement proposal, Phase I (the first 5 years) represents the required threshold scale to which a commitment must be made. An investment of $150 million on Phase I can produce about 50 million pounds of salmon annually, a level of increase which in turn will create a clearly distinguishable increase in benefit flows and will maintain the diversity of the resource base. Also, during Phase I, program evaluation and monitoring methodologies and techniques will be designed, tested and applied. In this latter regard, the aim is to develop management tools to the degree of sophistication which will assure that investment decisions will produce desired economic and social results where and when they are needed.

Activities scheduled during Phase I of the program will be largely similar to those of any other resource development program. Design, construction and operation of fish production facilities over the 5 years will account for the major portion of effort (79%). Functions related to this production activity including biological-engineering feasibility and research, project evaluation, program direction, administration and planning will require a somewhat larger effort (18%) because of the need to "front-end load" these activities. The activities that are not always common to other developments are the public involvement and economic research functions which comprise 3.0% of the effort. These activities are considered essential to provide some early benefits, but more importantly to ensure that the predicted benefits will materialize in the later stages of the program.

Information generated during each year's program will be fed immediately into analysis of future options, thereby resulting in the continuous shaping and reshaping of implementation plans. Given the foregoing, year one implementation plans (1977/78) can be taken as firm, year two as firm but subject nevertheless to revision based on analysis during year 1. Years three to five are proposals subject to significant changes based on 2, 3, or 4 years of analysis.

Financial Flow

The following describes current best estimates of financial flow over Phase 1.

a) Fish Production Projects

These include full production facilities and pilot or prototype scale projects which will produce more fish. The proportion of annual investment in these activities should rise from 60% in the first year to over 75% by year 5.

i) Minor (stream) Projects and Economic Development

Two classes of activities are included. The first is a small stream restoration and improvement sub-program carried out by in-house technical staff. The second is a small stream and minor enhancement facilities sub-program carried out by community groups and small enterprises, under technical supervision and with the co-operation of other federal departments.

The small stream sub-program carried out by in-house technical staff will peak by the fourth year and remain relatively constant over perhaps the next 5 to 7 years, after which this activity should decline to a relatively nominal level of less than $100,000 per year. Private sector sub-programs may, however, increase substantially beyond the 1981/82 level.

	77/78	78/89	79/80	80/81	81/82
Governmental	$300,000	400,000	400,000	500,000	500,000
Private Sector	400,000(1)	800,000(1)	1,600,000(1)	2,500,000(1)	3,500,000(1)

Note 1: These targets could be doubled by the addition of matching inputs by Manpower, DINA or DREE.

ii) Pilot/Prototype Production

This includes the application of a number of techniques which have passed through the experimental stage and are ready to be tested under field conditions. Examples of these techniques are: controlled lake and stream enrichment; Japanese style hatcheries; semi-natural rearing channels; stream engineering.

Scale of investment could peak by year four. Thereafter, the investment rate could remain relatively constant as proven pilots are converted to production units, others are dropped, and new techniques enter the pilot stage.

77/78	78/79	79/80	80/81	81/82
$ 1,200,000	2,200,000	2,500,000	3,000,000	2,500,000

iii) Major Facilities

Design and construction of production units are included.

A total of 56 major facilities will be completed or under construction by the end of year five.

77/78	78/79	79/80	80/81	81/82
$ 3,500,000	9,500,000	17,000,000(1)	22,000,000(1)	29,000,000(1)

Note 1: Interchange of funds between years three, four and five may be desirable, dependant on information generated by bio-engineering feasibility studies conducted in years one, two and three.

b) **Facilities Operations**

Provision is included for meeting the operating cost of facilities constructed during Phase I. These costs rise from 2 1/2% of the budget in the first year to 8 1/2% by year five.

77/78	78/79	79/80	80/81	81/82
$250,000	700,000	1,500,000	2,500,000	4,000,000

c) **Bio-Engineering Feasibility**

Included are the broad general reconnaisance studies which wind down after four years and the site and stock specific biological and engineering feasibility studies which should peak by year four and begin to scale down thereafter.

Also included are project evaluation studies which will be undertaken on a selective basis. These studies generally will be carried out over a complete salmonid life cycle (two to five years depending on the species and stock). This activity will increase steadily during Phase I and maintain the year five level of effort over the next decade.

Some component research is also included, particularly in the fields of fish diseases and nutrition as well as some specific engineering research directed to improving the efficiency of enhancement systems.

77/78	78/79	79/80	80/81	81/82
$1,600,000	3,600,000	5,500,000	6,000,000	5,000,000

As a percentage of the annual budget, these activities will fall from a peak of about 18% in year one to about 11% by year five.

d) **Public Involvement**

Activities within this component include education and information, minor enhancement projects, seminars and workshops, advisory arrangements, consulting services. These activities are based on the need to increase the community awareness of the problems of salmonid's survival, to inspire awareness of solutions to these problems, and to strengthen the role of the public in helping to conserve the salmonid resource and its habitats.

After an initial impetus in year one, effort will scale down to a basic information-in, information-out program. Costs in year one and two are inflated by the need to continue with professional consulting service over the first 18 months of implementation.

Costs range from a high of 6% of the budget in the first year to about 0.5% in year 5.

77/78	78/79	79/80	80/81	81/82
$550,000	500,000	300,000	300,000	250,000

e) **Economic Studies**

A number of social and economic research needs have been identified. These include: analysis of existing and future supply and of existing and potential demand as background to development of plans which best meet desired goals; the modelling of the Pacific Coast salmon industry; development of a monitoring and evaluation system; specific research in the context of the five account system.

It is assumed that research effort can be scaled down after two years from about 9% of program effort in year one to about 0.6% in year five.

77/78	78/79	79/80	80/81	81/82
$450,000	450,000	300,000	300,000	300,000

f) **Program Direction and Control, Administration**

An Executive Board to manage the S.E.P. is proposed. This Board would be responsible for implementation of Phase I, including the on-going planning and evaluation. The Board would direct and control operations through a Directorate.

The Directorate would implement policies of the Board; recommend on strategy to the Board; recommend on program guidelines and decision criteria; evaluate annual program proposals and recommend to the Board; monitor and control annual program implementation; provide secretariat service to the Board; report on progress to the Board. This Directorate would be the operating division of the S.E.P. with an essential nucleus of staff of professionals and support personnel.

The annual funding required during Phase I would decrease from about 8% in year one to about 2% by year five.

77/78	78/79	79/80	80/81	81/82
$750,000	850,000	900,000	900,000	950,000

g) Summary of Estimated Financial Flow

S.E.P. PHASE 1: ESTIMATED FINANCIAL FLOW

	77/78	78/79	79/80	80/81	81/82
a) Fish Production Projects					
i) Minor Projects and Economic Development	$700,000	1,200,000	2,000,000	3,000,000	4,000,000
ii) Pilot Production Projects	1,200,000	2,200,000	2,500,000	3,000,000	2,500,000
iii) Major Projects (Design and Construction)	3,500,000	9,500,000	17,000,000(1)	22,000,000(1)	29,000,000(1)
b) Operation of Facilities	250,000	700,000	1,500,000	2,500,000	4,000,000
c) Bio-Engineering Feasibility, Evaluation	1,600,000	3,600,000	5,500,000	6,000,000	5,000,000
d) Public Involvement	550,000	500,000	300,000	300,000	250,000
e) Economic Studies	450,000	450,000	300,000	300,000	300,000
f) Program Direction and Control, Administration	750,000	850,000	900,000	900,000	950,000

(1) Interchange may be desirable between these three years, if feasibility studies warrant.

III DESCRIPTION OF PHASE II

The goal of Phase II would be to use the S.E.P. as a regional economic generator and development tool to achieve government's economic and social targets. The creation of new wealth through increased production of salmonids and the distribution of this wealth would be the means for achieving these targets.

In this approach, the annual rate of investment would be controllable. While it would be technically possible to vary the rate of investment from zero to about $100 million per year, it is more realistic to assume a range of $30 to $60 million per year until the safe biological limit of 190 million pounds of increased production is attained.

However, it is also clear that investment could be cut off at any stage after Phase I, without significant negative economic or biological consequences. From Phase I on, each increment of investment can be discrete and independent of other inputs.

There are on-going costs which arise from each increment of investment. For the most part, these are costs which result from operation of newly constructed enhancement facilities. As will be noted from II (b) above, these fixed annual costs will reach $4 million by the end of year 5; by year 6 these costs will rise to about $6 million (as a result of investment in facilities during year 5). Operating cost increases after year 6 are tied to each year's investment in construction of fish facilities.

Recovery of both investment and operating costs is possible as shown in the Economic Rationale Section.

2. THE TECHNICAL RATIONALE FOR SALMONID ENHANCEMENT

I THE BASIC SALMON RESOURCE

During the last half of the previous century, British Columbia's salmon resource could have produced catches twice as great as those of the present day. A species by species, area by area investigation of past performance and future capacity concluded that the five species of Pacific salmon have a combined productive capacity of between 300 and 360 million pounds per year.

These historic levels of the five species are difficult to document because catches recorded in the initial years of the commercial fishery do not fully demonstrate the magnitude of all stocks. In the early years of the fishery the industry concentrated heavily on the most valuable species in the most accessible areas, often over-harvesting some stocks and under-harvesting others. Characteristically, when one species or one area declined in productivity, the intensity of fishing would shift to another species or another area. It was not until the 1930's that the industry had seriously fished on all species in all areas. By this time, major declines had occurred in many stocks of most species.

By the beginning of the 1930's most stocks were well below previous levels and the average total catch for the five species was about 180 million pounds and still declining. By 1940 the ten year average was 164 million pounds per year; by 1950, 155 million; by 1960, 137 million - an all time low.

After World War II, a marked increase in industrial development and urban growth provided an increased threat to the already depressed stocks. By this time overfishing, illegal fishing and lack of management knowledge were also recognized as causes of the decline of these stocks. The Federal Government responded to these situations by providing a major increase in conservation, protection and enhancement effort. By the end of the 1960's, the decline in catch had been halted and the ten year average catch had risen to 139 million pounds. Catches during the 1970's as shown by Table 1 bring the current ten year average to 145 million pounds.

These gross averages indicate that the decline in basic stock levels has been halted and levels may now be increasing. This is not true for two reasons:

1. Significant numbers of salmon have been added to the basic natural stock by fishways, spawning channels and hatcheries recently constructed in Canada. There is good evidence that these enhancement facilities annually add 2 million salmon to the catch and if Canada's catch from the production increases of U.S. hatcheries is included, this total would approach 3 million "new" salmon per year.

2. Improvement in stock management precision and strong pressure, from an increasing fishing fleet capacity, has added significant numbers of fish to the catch that would, in earlier years, have entered the spawning streams as surplus escapement.

TABLE 1 AVERAGE COMMERCIAL CATCH (1966-1975) AND CURRENT VALUES (AVG. 1975-76 PRICES) FOR PACIFIC SALMON

Species	Number of Fish	Landed Weight	Landed Value (Avg. 1975 - 1976 Prices)	Wholesale Value (Avg. 1975 - 1976 Prices)
	'000's	'000 lbs.	$'000	$'000
Sockeye	5,234	32,048	22,113	54,161
Pink	10,407	40,247	12,879	41,052
Chum	2,743	30,451	17,357	30,756
Chinook	1,312	16,177	17,309	28,633
Coho	3,804	26,131	23,779	39,458
TOTAL	23,500	145,054	94,437	194,060

Without these extra fish the catch levels would show a continued decrease. It is evident, therefore, that the causes of decline are still operating, but it is also evident that a method to increase production has been developed. Enhancement will not, however, offset the losses from natural production of the numerous and dispersed salmonid stocks. Close inspection of these causes of decline shows that they are now operating in a very different manner than they were during the early years of the fishery. Environmental degradation once took its toll of salmon through major catastrophic losses from time to time. But now thousands of small industrial and urban development projects are each causing insidious fractional losses that are difficult to document and control. Similarly, overfishing no longer decimates large stocks of fish, but small marginal stocks are often lost as a result of pressure from a dramatically increased fishing capacity which harvests these fish incidental to the larger target stocks.

II THE ENHANCEMENT TECHNOLOGY

Canada's Pacific salmon resource is now precariously balanced between extinction and survival. Without positive action there is good reason to believe that the balance will tip toward extinction. The fish culture technology that Canada has developed and financed over the last few decades is now proved and ready for full-scale application. These enhancement techniques are available to increase salmon stocks to their historic levels of abundance if improved habitat protection and stock management regimes are applied concurrently to protect the natural base level of salmonid production. These enhancement techniques are all designed to improve survival at one or more stages of the life cycle of the salmon. It must be remembered that the salmon is only seen for the small fraction of its life when it moves into the fresh water to spawn and die, and when its progeny moves out to sea to rear throughout its maturing years. Fortunately, in a management sense, it is during this fresh water stage that most of the natural losses occur. Consequently, if the fresh water needs of the salmon are looked after, their production can be enhanced. This is a form of semi-cultivation where controlled or improved conditions provide high survival only in the early hazardous stages of the salmon's life. Increased numbers of young salmon then migrate out of the fresh water rivers and streams to feed, on the rich pasture of the ocean, each returning in one to five years as several pounds of high quality protein.

Techniques have been developed in recent years that can be applied to achieve these increases in fresh water production of young salmon. Spawning channels, hatcheries and fishways are the principal facilities; other facilities such as incubation units, rearing ponds, stream improvements and flow control are portions or outgrowths of these techniques.

Spawning channels are simply man-made streams designed to provide the best conditions for spawning and incubation. They provide egg-to-fry survivals four to eight times as great as the average in natural streams. Channels are especially useful to produce pink and chum salmon which go immediately to salt water to feed. They are also useful for sockeye whose spawning streams do not produce enough fry to utilize the rearing capacity of the lakes in which they must feed and rear for a year.

Hatcheries are used to "short-circuit" the freshwater life of salmon. The key to this technique is that they provide not only for the incubation of eggs, but also for the rearing and feeding of juveniles. Hatcheries are especially useful for chinook which spend from three months to a year in freshwater streams and for coho and steelhead which spend at least a full year in freshwater.

Fishways provide access for all species to upstream areas that are unutilized because of natural or man-made barriers in streams.

All of these techniques have gone through the experimental, pilot and production size stages successfully. Spawning channels for chum salmon at Qualicum River, for pink salmon at Seton Creek and for sockeye at Weaver Creek, Pitt River and Gates Creek are production sized facilities that are now providing benefits in each production year equal to the original capital costs of construction. While not yet fully effective, the $9 million Babine Lake project has yielded results which suggest that the benefits will be higher than anticipated when the project was initiated.

Hatcheries for Pacific salmon have been in use in Washington and Oregon since the turn of the century. It is only in the last 15 years, however, that success has been achieved and this was only with chinook and coho. This breakthrough came as a result of intensified research on nutrition, disease control, feeding techniques, water quality and timing of fry release. The 21 State and Federal hatcheries on the Columbia River were recently evaluated and, based on their methodology, showed benefit-cost ratios for coho at 7:1 and fall chinook salmon at 3:1. The performance of the 12 Washington State hatcheries in Puget Sound is considered to be equal or greater. Canada followed this program and developed an experimental chinook and coho hatchery at the Qualicum River in 1968 where studies showed that United States results could be repeated in Canada. The first production hatchery was completed in 1971 on the Capilano River at a cost of $3 million, and early returns support the conclusion that production efficiencies will exceed those achieved in the United States. A second and larger hatchery costing $5.2 million is now coming into full operation at the Quinsam River near Campbell River.

Out of the 20 Fishways that have been built in the Pacific Region since 1954, only two have not justified their costs. The four fishways on the Fraser (including Hells Gate) have returned salmon with a total catch value of $60 million in the first 20 years for a capital outlay of $2.3 million in the late 1940's. The Meziadin Fishway on the Nass River built at a capital cost of $750,000 in 1966 provided an average annual additional catch value of $815,000 in its first three years of full operation. The value of other smaller fishways were not economically quantified but with minor exceptions they were considered successful in that the spawning runs of fish were able to move in good numbers beyond the falls or blockage to the upper reaches of the streams.

There are a number of new and promising techniques such as lake and stream enrichment, Japanese style hatcheries, stock transplants and genetic manipulation that are now in the advanced development stages and are ready for pilot application.

III ENVIRONMENTAL POTENTIAL

Historically the fresh and salt water environment has supported more than twice the present abundance of salmonids. Without enhancement, which increases survival during the fresh water life stages, the fresh water systems could not now support these historic levels of abundance. With enhancement technology however, the potential for increase is dependant largely upon the number of suitable sites for facilities. Investigations to date show that there are a large number of these sites, possibly enough to even triple present production. Environmental potential therefore becomes a question of the rearing capacity of the coastal estuaries and the open ocean.

Many estuaries have been disturbed by man. They have been filled, dredged and had toxic wastes dumped in them, all of which has reduced their productive capacity. On the other hand, the addition of large quantities of nutrient material in some estuaries has increased their productive capacity. On balance, however, there has probably been a loss of carrying capacity in estuaries. Although techniques are being developed for enhancing estuaries they are not yet available for application.

Ocean rearing capacity, a key component in salmonid production, is a function of such factors as climate, food organisms, competitors and predators. The present consensus appears to be that climate is changing toward that observed near the turn of the century when salmon abundance was at its historical maximum. Observations of fish food organisms in the salmon rearing area in the Gulf of Alaska between 1957 and 1976 suggest little or no net trend, although marked fluctuations were detected. A striking feature of the Gulf of Alaska and British Columbia coast is the decrease in the numbers of competitors, such as whales, ocean perch, hake, pollock, herring and halibut, that has occurred since the high levels of salmon abundance near the turn of the century. Recent increases in potential predators such as fur and harbour seals have occurred but historical stocks of salmon probably co-existed with larger numbers of fur seals, prior to the period of heavy seal exploitation. Ocean rearing capacity is therefore unlikely to limit the doubling of salmonid production.

A staged, carefully monitored enhancement program could detect the approach of production to the limits of rearing capacity, and guard against exceeding it.

IV PROCESS FOR DEVELOPING PROJECT PROPOSALS

The estimated potential for enhancement in the freshwater environment with existing proven technology is judged to be approximately 40 million salmonids. For the purposes of planning, a production target of 25 million additional adult fish per year was set on the rationale that:

> This production plus current natural production would approximate the probable historic level of production; hence, should not exceed the carrying capacity of the marine environment;

This level of increased production would contribute to fully utilizing existing commercial processing capability; and

The projected demand of recreational and native Indian food fisheries to the year 2007 could be met.

Within this overall target, targets for each species were developed for each of 8 geographic areas considering biological potentials, engineering feasibility, site suitability, and economic factors such as enhancement unit production costs, commercial values, existing technologies, and the salmon managers' perception of socially desirable projects. Three Federal-Provincial geographic working groups were charged with proposing a strategy of enhancement to meet these targets, guided by many of the above considerations, plus a knowledge of local opportunities and problems. They also applied a list of project selection criteria which included: saving threatened stocks, extending the fishing season, dispersing the fleet, improving the technology, reducing management risks, minimizing international interceptions, preserving future enhancement options and improving the opportunity for Indian participation.

The species, costs, productions, timing, etc., of the projects proposed in the strategy for each area were analyzed and arrayed by a computer based "production model". This model "allocates" production from enhancement facilities to the specific fisheries in which they will be harvested under three different allocation options. Applying the methodologies outlined in the Federal Treasury Board's Guide to Benefit-Cost Analysis, the model is intended to transform technical information into a form usable for economic analysis.

This initial program plan, which identified 170 separate projects, was then analyzed by an Economic Working Group and was presented to a number of public/client advisory groups for their consideration and feedback. Because of time constraints, the Economic Working Group was able to complete analysis of only the first 29 projects; i.e., those with enough biological and engineering investigation to make them clearly feasible in the initial stage of the program. The client advisory groups made recommendations on species mix, geographic distribution of enhancement effort and strategies for implementation of techniques, favouring small stream restoration and small-scale projects generally.

An iteration cycle has been set in motion in a process that will be on-going. For example, with the feedback from the client advisory groups and the Economic Working Group, the results of a number of social, economic and technical studies conducted in the past two years, the findings of 19 public hearings, the guidance of a series of 'State of the Art' technical workshops, advice of a Research Working Group, and a managerial Task Force and executive Steering Group, the technical groups will adjust their proposed strategies. This iteration process will be repeated at each stage as the program evolves. The program is designed as a dynamic and evolving process, a process that will be responsive to the legitimate and changing needs of people and to targets of government for economic growth and social improvement.

V PROGRAM OPTIMIZATION CONSIDERATIONS

Salmon management, if it is to contribute effectively to society's goals, must operate within an extensive framework of criteria. Salmon management in this case is considered to include habitat protection, enhancement, stock management, enforcement and regulating the industry. The criteria are largely social, economic and technical. The nature of the fish defines and limits the timing, magnitude and quality of social and economic benefits which can be derived from its use. The salmon manager, therefore, must always be fully cognizant of biological and other technical limits and risks associated with utilizing this sensitive and unique renewable resource.

Social, economic and technical criteria identify the broader considerations which will be taken into account when integrating the various component project proposals into a unified enhancement program.

1. Broad Management Considerations

(a) Maintain the Present Species Distribution

The present species distribution will be maintained until a rationale for varying it is understood and agreed to. Redistribution would affect catch by gear, area and time of year, and final product use. The present balance should be maintained until the natural effects of alteration can be determined and a conscious decision made.

(b) Extend the Fishing Season

The salmon manager will endeavour to extend the fishing season on as broad a basis and for as long as is economically viable, given the assumption that spawning goals are being met. This extends the period of meaningful employment, thereby reducing demands on unemployment insurance and welfare and minimizing under-utilization of existing catching and processing facilities. A longer fishing season could be achieved by rehabilitation and enhancement of stocks which are fished early or late in the season.

(c) Disperse the Fishery

By spreading the fleet more evenly over the entire coastal fishing zone, competition with less mobile fishermen or those from remote communities is reduced. This dispersal also helps to extend the fishing season, reduce conflict between fishing gear types and reduce fishery management risk, hence permits harvesting minor stocks more safely. The fleet could be dispersed by rehabilitation and enhancement of those salmon stocks which would be fished in a location and time that the present fishery is minor or non-existent.

(d) Equitably Distributing the Catch

The salmon manager must try to maintain an equitable balance within and between sequential fisheries, fishing gears, areas, seasons, years and between catch and escapement. The benefits of equity are self-evident. Natural variation of fish production often threatens equitable distribution of catch.

(e) Improved Management Capability

Optimization of salmon management capability is sought to reduce risks and consequence of error while more fully exploiting the harvestable surplus; to extend seasons; to improve protection of fish habitat; to develop more responsive and flexible management in relation to both users and the resource. Such benefits can be achieved by enhancement to stabilize production of naturally unstable stocks and to equalize the production rates of stocks which are fished together.

(f) Maintain and Rehabilitate Small Streams

Small stream salmon production, the backbone of our present supply, is especially subject to deterioration attributable to man's and nature's activities. Unless these streams are protected, maintained and, if required, rehabilitated, the production losses will affect all fisheries. These activities can increase production over a broad area at a minor cost.

2. Enhancement Technical Selection Criteria

The three areas of salmonid enhancement technical feasibility are "manageability", "enhancability", and "technical desirability". Within each of these broad areas, several criteria must be met if each project is to provide its maximum contribution toward optimal yield and minimum risk.

(a) Manageability

Enhanced stocks must be manageable or they should not be enhanced. This means that the stock to be enhanced is demonstrably manageable as a discrete unit at the proposed levels of production; i.e.,

- it can be harvested without over-exploitation of other stocks;
- it does not detrimentally interact with other valuable stocks (by predation, competition, etc.);
- it does not exceed the carrying capacity of freshwater or estuarine environments.

(b) Enhancability

The site and stock to be enhanced must be such that unnecessary and out-of-the-ordinary costs and risks are not likely to be incurred.

- there is an available supply of water and land of suitable quantity, quality and accessibility.
- the site can be utilized with minimal disruption of other natural resources and does not require excessive use of technology or power.
- the proposal is not conditional on additional future expenditures in order to generate net benefits.
- the stock to be enhanced is sufficiently abundant that only a proportion of the stock is required to fully utilize the proposed facility, unless there are very special mitigating circumstances.
- the stock, site and proposed technique has its disease potential identified.

(c) Technical Desirability

Projects should offer technical as well as social and economic benefits, including:

- contribution to technological development that would improve the efficiency of future program components.
- protection and rehabilitation of threatened stocks (maintenance of gene pools) and natural habitat.
- minimization of technological risk; i.e. facilities of low complexity are preferable to those of high complexity.
- maintenance of salmonid production options by assuring that the project will not foreclose future options for that system and by placing high priority on projects in watersheds threatened by other industries.
- maintenance of options for other industries by minimizing impacts on other natural resources.

- minimization of opportunity for interceptions of stocks by other countries.

- contribution to knowledge in a way that can be evaluated.

- contribution to stability of annual production.

- minimization of energy needs for operation of facilities.

VI TECHNICAL PROGRAM FLOW

The previously described process resulted in a program proposal consisting of a number of enhancement projects distributed throughout the province (Figure 1). These projects, if constructed, would annually produce an additional 27 million salmon with a landed weight of 190 million pounds. The choice of species, the nature of the technology and the geographic distribution were determined by the project selection criteria described in a previous section of this report.

The initial candidate list of projects is presented in Table 2. Projects numbered 1-28 have been thoroughly analyzed within the five accounts. The rest of the projects have been evaluated for benefit-cost. It is possible to move some of projects 29 to 103 forward in time. For example, in response to input from a number of public/client advisor groups it may be desirable to move forward projects in the Central Coast area or projects that produce pink salmon.

Because of time constraints in conducting project reconnaissance, feasibility and design, production projects other than those listed in 1 to 28 cannot be constructed in the first two program years. It is, however, possible to implement minor production pilot scale projects and stream improvement work during that period.

The scheduled timing of this increased fish production to the catch is shown cumulatively in Figure 2 for each species along with the scheduled time of completion of the new production capacity. The increments of increased production by species are plotted on a cumulative basis such that the uppermost line on the graph represents the total increase to production from all species and the distance between each lower line represents the increased production of each of the named species. Increased production of steelhead is so small, relative to salmon, that it does not show on the graph scale.

Table 3 divides the total increase in production for each species into the percentage production for each of the broad geographic areas of coastal British Columbia. It is shown for example that the increased average sockeye catch of 6.4 million fish will originate approximately 12.3 percent from the streams of the North and Central coast; 4.4 percent from Georgia and Johnstone Straits; 20.9 percent from the West Coast of Vancouver Island and 62.4% from the Fraser River area.

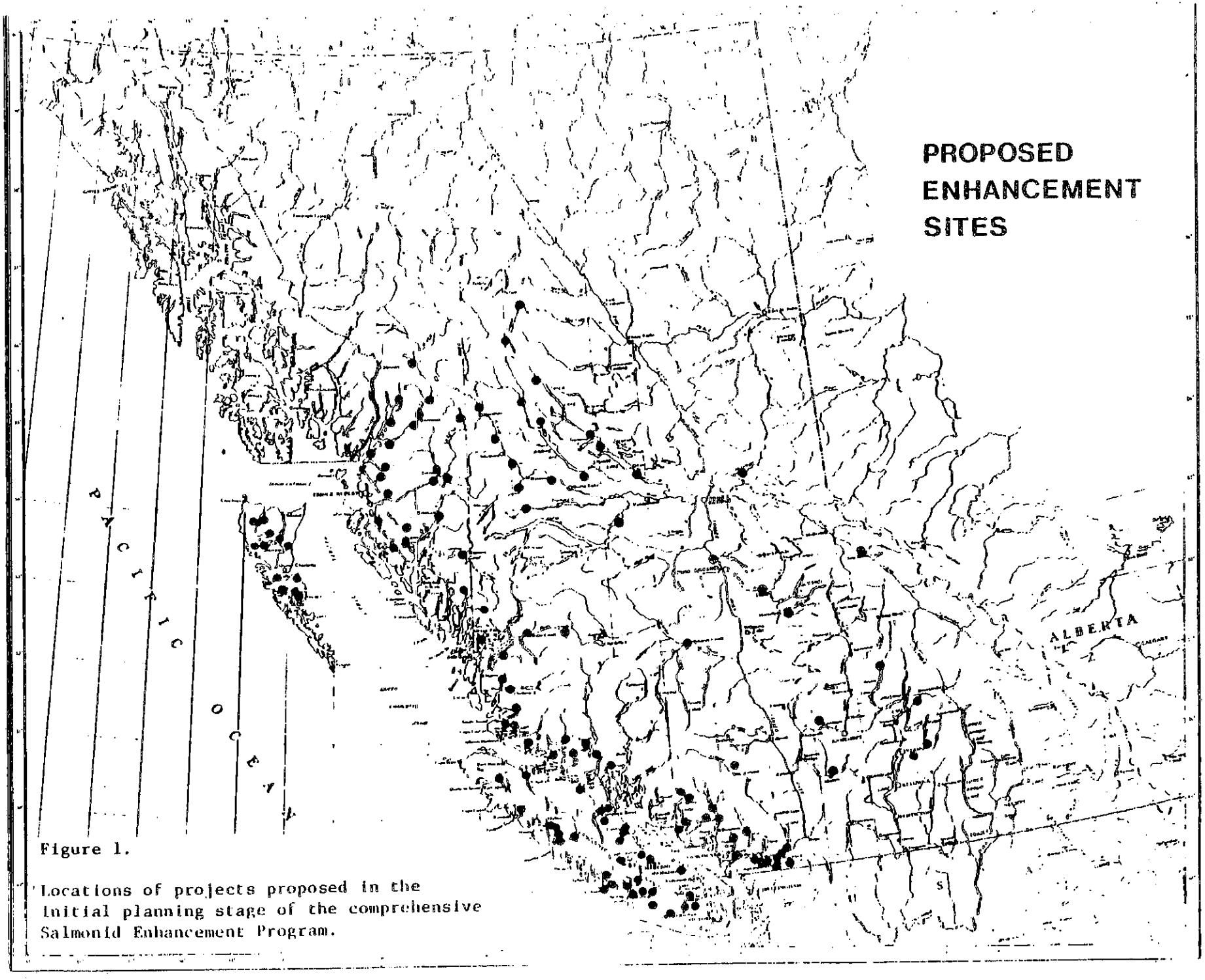

Figure 1.

Locations of projects proposed in the initial planning stage of the comprehensive Salmonid Enhancement Program.

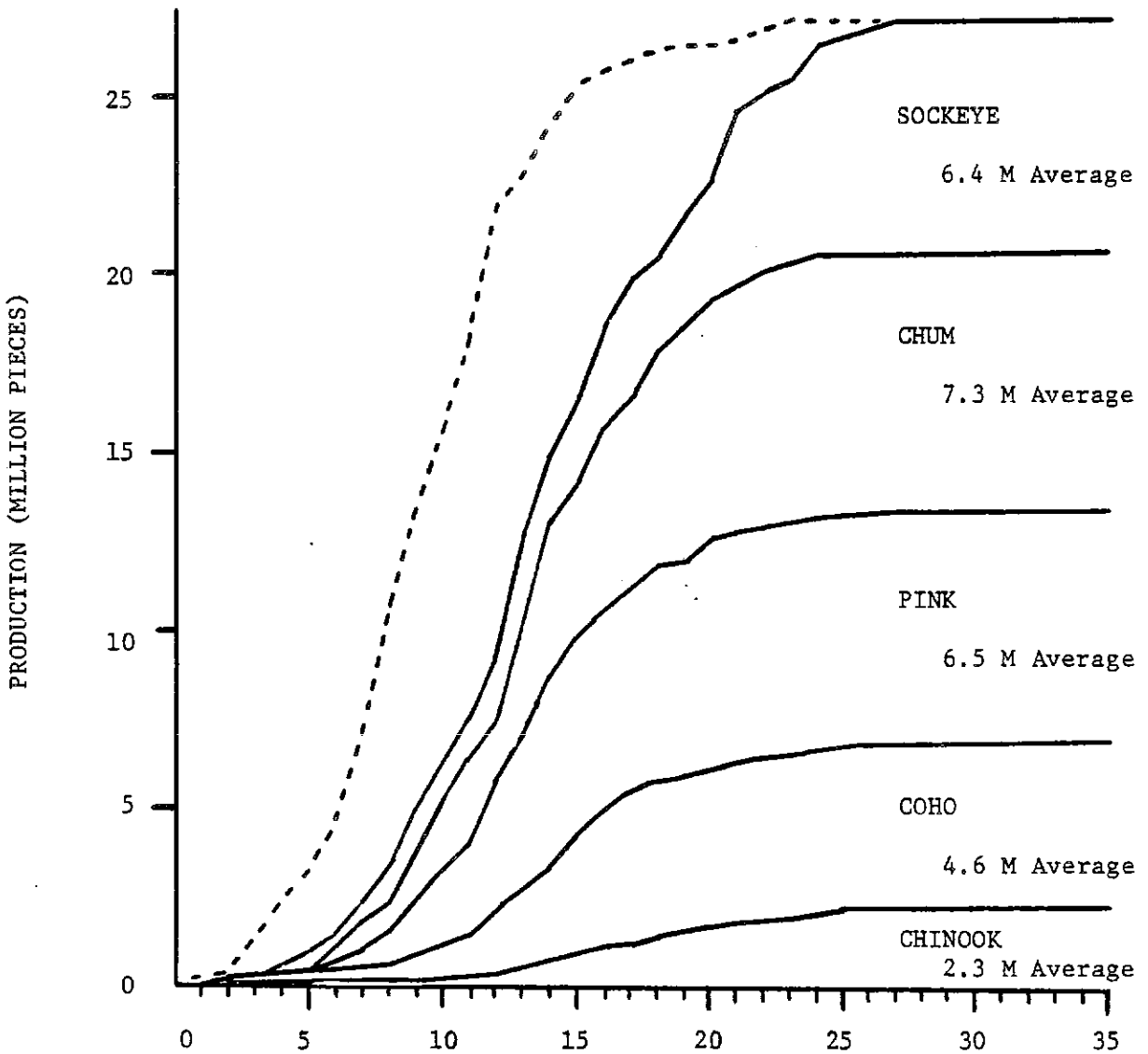

FIGURE 2. Timing of increased production to catch by species (solid lines) compared with time of completion of production facilities (dotted line).

TABLE 3: PRODUCTION TARGETS FOR EACH SPECIES BY BROAD GEOGRAPHIC AREA EXPRESSED AS A PERCENTAGE TOTAL PRODUCTION FOR THAT SPECIES

SPECIES	PRODUCTION (MILLIONS OF FISH)	NORTH & CENTRAL COAST(%)	GEORGIA & JOHNSTONE STRAITS(%)	WEST COAST VANCOUVER ISLAND(%)	FRASER RIVER (%)
Sockeye	6.4	12.3	4.4	20.9	62.4
Chum	7.3	37.3	30	12.3	20.4
Pink	6.5	49.3	17.9	-	32.8
Coho	4.6	35.7	21.4	13.1	19.8
Chinook	2.3	23.3	13.2	20	43.5
Steelhead	.08	31.3	23.8	13.8	31.3

Phase I: The First Five Years

The first five years of the program are the key to creating the flexible, responsive program described. Phase I not only establishes program direction, operations and climate for implementation, but it also is in this period that the range of technical options will be more fully developed. The biological and engineering feasibility has been demonstrated on enough projects to fill the first 2 to 3 years of the program. Also, reconnaissance and feasibility projects have been initiated to provide projects for later in the program (project flow is illustrated in Table 4). Early in the program a heavy emphasis would continue on broad areas progressively shifting to specific areas and sites. This would provide an ever increasing number of "feasible" enhancement options to choose from. The program would offer an increasing number of options through both time and level of investment. Up to a point the more investment in, the more options out, however, too much investment could foreclose some options.

TABLE 4: SAMPLE PROJECT EXPENDITURE ($'000's) OF A TYPICAL MEDIUM-SMALL PROJECT OF CAPITAL COST $2.11 MILLION AND PRODUCTION OF 200,000 CHUM

YEAR	1	2	3	4	5	6	7	8	9	10	11
Rec	60										
Bio. Feas.		72	72	72	72						
Eng. Feas.		75									
Design			105								
Const.				1055	1055						
Opts.					70	172	172	172	172	172	172*
Eval.					10	15	15	15	10		
Total Costs	60	147	177	1127	1207	187	187	187	182	172	172
Production								40	150	200	200*

NOTE: If stocks are low it may take one or more cycles before full production is attained.

* Operation of facility continues for project life.

VII SUMMARY

Proven salmonid enhancement techniques, such as hatcheries, spawning channels and fishways, are available for wide spread application. A number of developing techniques offer great promise of improved production at reduced cost.

The biological potential, in both fresh and salt water, exists to double the present salmonid production from 25 to 50 million fish per year.

Technical selection criteria have been established to minimize the chance of technical, biological or fishery management failure of enhancement projects and to maximize the achievement of technical, social and economic benefits from the projects and the program.

A joint Federal-Provincial planning process has been set in place which has to date identified 170 potential projects across British Columbia which would produce an additional 25 million salmonids to the annual catch. In addition to the biological, engineering and economic assessment process a public/client process has been initiated to provide guidance on program development. The program is being carefully evaluated to assure its contribution of economic and social benefits. These planning processes are foreseen as developing into an implementation system responsive to the aspirations of government, public and client groups.

For the above reasons, it is concluded that the technical capability exists to implement a balanced program of salmonid enhancement, habitat protection and salmonid management to maintain and enhance to historic levels the salmonid resources on Canada's Pacific coast.

3. THE ECONOMIC RATIONALE FOR SALMONID ENHANCEMENT

OUTLINE

1 Introduction

2 Benefit - Cost Analysis: A Multiple Objective Planning Framework

3 Multiple Objective Planning: Decision Criteria.
- A. The National Income Account
  - (i) Social Benefits by Purpose
  - (ii) Social Costs by Purpose
- B. The Regional Development Account
- C. The Native People Account
- D. The Employment Account
- E. The Environmental Account.

4 Analysis of Projects
- A. Large Scale Fish Production Facilities
- B. Analysis of Existing and Potential Demand
- C. Small Scale Economic Development Projects

5 Socio-Economic Impact of a Salmonid Enhancement Program Proposal.
- A. The With-Without Criteria
- B. The Salmon Industry in British Columbia
- C. National Income and Employment Impacts
- D. Regional Development Impacts
- E. Native People Impact

6 Social and Economic Research Needs
- A. General: The Basic Elements of Planning
  - (i) Analysis of Existing and Future Supply
  - (ii) Analysis of Existing and Potential Demand
  - (iii) Plan Formulation
  - (iv) Modelling of the West Coast Salmon Industry
  - (v) Monitoring and Evaluation
- B. Specific Research in the Context of the Five Account System
  - (i) The National Income Account
  - (ii) The Regional Development Account
  - (iii) The Native People Account
  - (iv) The Employment Account
  - (v) The Environmental Account

7 Policy Issues

A. Economic Rent Generation and Cost Recovery in the Commercial Fishery
   (i) Introduction
   (ii) Cost Recovery Potential of the Salmonid Enhancement Program

B. Fleet Size Policy Issues
   (i) Introduction
   (ii) Existing Fleet Capacity Requirements with Enhancement
   (iii) Investment Behaviour

C. Processing Capacity Policy Issues
   (i) Introduction
   (ii) Processing Capacity Requirements with Enhancement
   (iii) Industry Investment Behaviour

D. Economic Rent Generation and Cost Recovery in the Recreational Fishery
   (i) Potential Rent Generation
   (ii) Cost Recovery Mechanisms
   (iii) Present status of Tidal Sport Fish Licensing

E. Other Policy Issues in Recreation

F. Resource Use Interactions

3. THE ECONOMIC RATIONALE FOR SALMONID ENHANCEMENT

1 Introduction

In 1976, a Working Group of Federal and Provincial (B.C.) Government economists was constituted to oversee the economic and social planning of the proposed Salmonid Enhancement Program. Immediate priority was given to an evaluation of alternative long - and short-range salmonid enhancement proposals. The approach taken was to analyse, as fully as possible, the impacts of alternative approaches to salmonid enhancement on national income and employment, on regional development, on Native People and on environmental goals of government. In this way it would become possible to make explicit to Department of Fisheries and the Environment decision-makers the trade-off among objectives inherent in any particular salmonid enhancement plan. Furthermore, an iteration process developed among the Economics Working Group, the various bio-engineering working groups and decision-makers, would lead to the evolution of a development plan exhibiting an appropriate balance of the social and economic objectives of government. This Annex reports on the results to date of the Economics Working Group's endeavours.

A comprehensive framework for the identification of the appropriate goals and objectives of government expenditures, and the necessary planning procedures to achieve them has been evolving in Canada over the last two decades. In March 1976, the Planning Branch of the Federal Treasury Board published a report entitled Benefit-Cost Analysis Guide. That study provided the Economics Working Group with the methodological framework within which to calculate the appropriate range of benefits and costs of salmonid enhancement proposals. The explicit display of benefits and costs in terms of an account system, which reflects the multi-dimensional goals of the federal government's resource development policy, reflects recent trends in United States resource planning and evaluation procedures. This report draws heavily on several U.S. Water Resource Council publications including the Report of the Special Task Force on Procedures for Evaluation of Water and Related Land Resources Projects (1969).

2 Benefit-Cost Analysis: A Multiple Objective Planning Framework.

The benefit-cost approach recognises that society has a multiplicity of goals, some quantifiable in national income terms, others not. In the same context the benefit-cost analysis of salmonid enhancement proposals conducted by the Economics Working Group also recognises that fishery development projects have impacts beyond those measurable in national income terms. Accordingly, a framework has been developed which attempts to forecast and describe not only national income impacts of salmonid enhancement proposals, but also environmental and distributional impacts as well.

In specific terms, a five account system has been established to detail the benefits and costs of development in terms of the following identified governmental goal areas:

1. National Income
2. Regional Development
3. Native People
4. Employment
5. Resource and Environmental Preservation

All benefits and costs measurable in monetary units are handled in the National Income Account. From the information which appears there, it is possible to establish the net national income benefits and the benefit-cost ratios for all economic purposes (commercial, recreational and native food fish production) of a proposed development. If the decision-maker were only interested in a single objective, namely the maximization of national income, then the analysis would need to go no further.

However, as implied above, the National Income Account ranking of projects in isolation from other accounts is not considered to be a serious alternative. It provides no more than a measure to be used in assessing foregone national income opportunities of other, multiple objective rankings, which have been developed to meet other objectives, such as improved regional income and employment distribution, enhancement of environmental quality, maximisation of Native People benefits etc.

For example, government may choose to save a unique and threatened run of fish (Environmental Account), thereby lowering the potential net national income benefits of the overall program plan and incurring a real cost by foregoing some alternative plan with superior income generating potential. At this point, one need only draw attention to the nature of the trade-offs which are made explicit in the multiple objective framework of benefit-cost analysis:

1. In all cases, it is possible to account for the real costs of objectives other than national income maximization.
2. The benefits of meeting objectives under the Regional Development, Native People, Employment and Environmental Accounts are not measurable in National Income "dollars" and their value is largely a matter of judgement.
3. The question of whether the environmental and regional development benefits, for example, of a particular development plan are worth less, the same or more, than the amount of national income gains foregone, will have to remain a matter of judgement by policy-makers in each and every case.

Within the framework outlined above it becomes possible to integrate the national income/efficiency aspects of salmonid enhancement proposals with the broader social and economic potentials of such a program. Program choices may be constrained by some minimal required level of net national income benefits, out of which, for example, it would be possible to recover the government's investment costs. However, having satisfied this constraint, the Salmonid Enhancement Program is capable of producing a wide range of social and economic benefits. These benefits may be measured by further net additions to national income or by some other socio-economic indicators such as employment, income generated for specific disadvantaged groups, environmental quality etc. The benefit-cost analysis framework to which the Economics Working Group aspires is, therefore, the planning tool which evaluates the consequences of plans that incorporate varying mixes of the broader social and economic goals of government and allows them to be accounted in terms of national income foregone. It also allows an optimal balance of social and economic goals to be embodied in a recommended implementation plan.

At the beginning of this Section, broad goal areas of government were identified. The following paragraphs define the decision criteria through which alternative salmonid enhancement proposals can be evaluated. As the program progresses, a process of monitoring these decision criteria will measure the success of the program in actually achieving its stated objectives.

3 Multiple Objective Planning: Decision Criteria

A. The National Income Account

All benefits and costs measurable in "national income dollars" are handled in the National Income Account. The information which appears there details, for each economic purpose of the development, the following kinds of information:

(i) Social Benefits by Purpose

1. Value of commercial fish production, as measured by market prices of fish products.
2. Value of recreational fish production as measured by consumer surplus generated for Canadians plus net increase in enhancement-related non-Canadian tourist expenditures.
3. Value of Native Indian food fish production as measured by the net value of opportunities foregone in the commercial fishery.
4. Value of other purposes, e.g. flood control, etc.

(ii) Social Costs by Purpose

1. Value of commercial fish development and management, as measured by:
   (a) The value of capital, materials and operating costs of fish production facilities, determined by market prices.
   (b) The value of associated costs of fish harvesting and processing as determined by market prices.
   (c) The value of land and related natural resource costs associated with salmonid enhancement proposals, e.g.
   - the value of forestry production foregone
   (d) The value of direct and indirect labour employment, determined by - the market price of labour, assuming full employment of labour in the economy over the construction and operating life of the proposed development.

2. Value of separable costs of recreational fish development and management, as measured by the market price of capital, labour, materials and operating items.

3. Value of separable costs of Native Indian food fish development and management, as measured by the market price of capital, labour, materials and operating items.

4. Value of separable costs of other purpose benefits, e.g. the market price of separable capital, labour, materials and operating items associated with flood control etc.

B. The Regional Development Account

This account was developed by the member of the Economics Working Group representing D.R.E.E. The region of their interest is defined as the coastal areas of British Columbia north of a line from Bamfield to Powell River. A rating system has been designed, and applied to projects for the first two years located within this area. The ranking of projects was primarily based upon three factors.

- the size of the primary fishing revenue impact
- the probable geographic distribution of that impact in terms of who would likely catch the enhanced production
- and the socio-economic conditions in the area of impact

These factors were judgmentally weighted to determine the final ranking of project proposals in respect to their regional development opportunities. The result is to weight each project either high, medium or low.

C. The Native People Account

As in the Regional Development Account, a rating system was designed which allowed for the consideration of all important project impacts on Native People. The criteria considered were as follows:

- The annual Native incremental commercial catch implications of each project were ranked as either high, medium, or low. Since it is through the incremental catch that Native people will, in general, derive the greatest benefits from these projects, this factor was judgmentally accorded the greatest weight in deriving the final rating.

- The food fishing implications were classified as either important or unimportant, depending on the potential contribution of the project in alleviating (apparent) shortages in food fish supply.

- The employment implications of each project were judged to be either high, medium, or low depending on (1) the feasibility of employing Natives at the project (are there any nearby? are they interested? experienced? trained or trainable? etc.) and (2) the impact of the potential employment on the band (number of jobs relative to size of labour force, unemployment rate, band income, etc.)

- The implications of developing a sport fishing industry with related investment opportunities in tourism facilities and associated employment potentials for native people was considered in this account.

- Finally, the category other factors allowed for consideration of all important project impacts not included in the above categories. The factors considered here included some economic impacts (e.g. shoreworker employment), but the main emphasis was on social impacts (band attitude toward the project, potential for significant Native involvement in project management, etc.).

These five factors were judgmentally weighted to determine the final rating of project proposals in terms of the Native People Account. Once again the result was to rate each project as either high, medium or low: where high means that potential Native People benefits may be sufficiently great to warrant selection of an otherwise marginal project based on this account; medium means that other accounts must be considered as well; and low means that this account cannot be used to even partially justify the selection of the project.

D. The Employment Account

In the National Income Account, full employment is assumed for the purposes of the primary presentation. However, in the coastal areas of British Columbia, high rates of unemployment have been the norm over long periods of time. The Employment Account, therefore, has two purposes

(i) to rank salmonid enhancement project proposals on the basis of primary employment generated, and
(ii) to estimate on a project by project basis, the probability of hiring labour resources which would otherwise be unemployed.

The information generated feeds back into the National Income Account in a secondary presentation in which projected costs are reduced by using a "shadow price" for labour. This exercise is an attempt to account for the fact that the use of resources, which would otherwise be unemployed, entails zero social cost in terms of foregone national income.

E. The Environmental Account

As in the Regional Development and Native People Accounts, a rating system is being designed for the consideration of all important impacts on the Environmental Account. The decision criteria which are under consideration are:

- Size of Stock: The smaller the remnant stock in proportion to historic strength, the higher the value awarded.
- Unique or Unusual Stock: Large fish, ones that travel large distances, stocks not found in same or nearby system etc. receive a higher rating.
- Other Methods of Stock Recovery: Where alternative methods of bringing the stock back have been tried and failed a high rating is given; if alternatives haven't been tried a lower rating is awarded.
- Ability to Transplant from Other Stocks: If a stock is lost what options exist for recreating it by transplanting from similar stocks?
- Habitat Protection: High values are assigned under the Environmental Account to projects which fix the fishery's interest or stake in a watershed in which alternative developments are both imminent and menacing.
- Indicator of Environmental Quality: Preservation of runs which pass through urban areas are awarded a higher rating than remote ones on the argument that continuing efforts to maintain a measure of environmental integrity in urban or semi-urban streams are sustained by the existence of salmonids.
- Natural Means of Rehabilitation: Working in streams to restore a natural balance as a means of salmonid enhancement deserves a high rating on the Environmental Account.

- Species Interaction: Negative values are attributed to projects which may increase in-stream competition with other species or contribute to interception problems.
- Disease Potential: Negative values are assigned on the basis of the potential for disease, genetic problems and like concerns.
- Competition with Natural Stock, Same Species: Where a significant remnant of a natural stock is threatened with extinction by breeding hatchery fish, the Environmental Account should register a negative value.
- Fishery Management: contributes to the management of fisheries by strengthening a weak stock, by generating knowledge to improve management, etc.

At this stage a subjective weighting system is being pursued on an experimental basis in order to priorise Environmental Account considerations as either high, medium or low. Again, a high ranking means that potential Environmental Account benefits may be sufficiently great to warrant selection of an otherwise marginal project based on this account alone. A medium ranking means that other accounts must be considered as well and a low ranking means that this account cannot be used even to partially justify the selection of the project.

4 Analysis of Projects

A. Large Scale Fish Production Facilities

Table 1 represents the current list of candidate project alternatives for Phase I (years 1 to 5) of the Salmonid Enhancement Program. Part of this list, reproduced as Table 2(A), has been analysed recently by the Economics Working Group, according to the decision criteria outlined in this annex. The remainder of the list, reproduced as Table 2(B), has been analysed only partially and only in terms of National Income Account data. What is important is the process of optimisation which the planning framework is designed to promote, rather than the numbers yielded by this specific cut of the analysis. The planning process is an on-going iteration process among biologists, engineers, economists and other specialists. The data provided reflect a snapshot of that on-going process at one particular instant of time. With data for each of the Five Accounts presented as in Table 2(A), it is suggested that decision-makers are provided with all the information required to optimise their implementation plan. The development and perfecting of these planning techniques will continue throughout the program implementation phase and will in a short time, become the basis for choosing among enhancement options.

In particular, the Economics Working Group divided projects into THREE classes as indicated in Table 2(A), according to the type of information to be conveyed to decision-makers about projects in each of the classifications.

(1) The first class of projects meets the economic criteria for public investment given the biological and engineering assumptions. No further intensive investigation from the Economics Working Group is recommended and the projects could proceed in this form.

(2) The second class of projects may meet the economic criteria for public investment but, given the uncertainty in some of the estimates they are more susceptible to economic failure than projects in the first class. Detailed comments on each of the projects outline specific concerns.

(3) The third class of projects, in addition to not meeting the economic criteria for public investment would be extremely difficult to justify on non-income grounds.

This information when relayed back to the biologists and engineers is intended to stimulate new project and program alternatives for re-examination. Furthermore, such a process clearly indicates to the economists where more detailed research on benefits and costs is required.

The attached list of projects indicates the significant net national income benefits which could be generated by an economically-optimised program. Not only would this permit consideration of full cost recovery of the program's construction and operating expenses, but it would also allow the inclusion of some projects which could make a strong contribution to the broader social goals of government i.e. to the non-national income accounts.

B. Analysis of Existing and Potential Demand

Canadian salmon products are sold both for domestic consumption (44%) and export markets (56%). A larger proportion of frozen salmon (73%) is exported than canned salmon (47%). Table 3 shows the destination countries for Canadian salmon exports by product type. The United Kingdom is the largest market for canned salmon. The United States and France together make up more than half of fresh and frozen salmon exports. In general, the trends have been a shift toward more fresh and frozen salmon production both for domestic and export markets over the past twenty years. In recent years B.C. exports of salmon to the United Kingdom have been declining while exports to European countries, Japan, Australia and New Zealand have been increasing slightly.

Canadian exports compete with salmon from the other major producing countries, namely Japan, the United States and the U.S.S.R. Over the twenty-two year period between 1952 and 1974, Canadian landings made up about 16 percent of total world production. Japanese landings made up about 32 percent and the U.S.S.R. about 21 percent. In more recent years Canadian production has been close to 20 percent of the total. In all, world landings have declined over the period by about 25 percent. Exclusive of Canadian landings this represents a decline of about 1.8 percent per year in other countries' production. Over the past twenty-five years, these declining world landings, market area population growth of 1.5 percent per year and a shift to higher valued product forms have caused general relative price increases for salmon products.

A full econometric forecast of future salmon price behaviour requires forecasts of the future behaviour of the determining factors and econometric estimates of the quantitative impact of each factor.

Econometric estimations have been undertaken in various studies. Different formulations have been used and different factors considered. In most cases the models used have been oversimplified or not adequately specified. Not too surprisingly, wide ranges of results have been obtained. Thus there is considerable uncertainty regarding all the factors and relationships that will determine future salmon price behaviour. Nevertheless, it is still possible to determine different combinations of assumptions regarding the way factors interact and what range of price behaviour can be expected given reasonable ranges of assumptions.

An economic model is being developed to predict future prices. In this model assumptions with respect to Canadian salmon output, world (non-Canadian) salmon output, the price elasticity of demand, and population growth are postulated to determine the resulting ranges of price behaviour.

Essentially the results indicate that provided population in the market areas grows at the historical rate (1.5 percent per year), salmon prices will not fall and are more likely to increase despite a doubling, over thirty years, of Canadian output. This would be the case unless world (non-Canadian) output were to grow at 2 percent per year (an increase exceeding 80 percent over 30 years). Historically world output has been falling more than 1 percent per year and it is expected that even the various enhancement projects in the supplying countries could only reverse the historical trend to at most an increase of about 1 percent per year (a 35 percent increase over 30 years).

The results also show that if population were to remain constant, then unless non-Canadian output were to decline, future salmon prices could be expected to fall as a result of the doubling of Canadian output. However, the size of the fall under most assumptions is not that great. If, for example, non-Canadian output were to increase 1 percent per year and the price elasticity of demand was -1.5, then the price decline would only be 0.84 percent per year, less than 25 percent over a thirty year period. Only under extreme elasticity and non-Canadian output assumptions would the price decline be quite substantial.

In considering even more pessimistic assumptions, we determined that with an average price decline of 1.5 percent per year over the next thirty years (a trend which would require little population growth in the world market areas as well as highly inelastic demand), only 14 of the 56 candidate projects in Phase I which had been calculated as economic under the assumption of no price change would be uneconomic. The benefits from enhancement would fall 20 percent. On the other hand, if prices were to increase 1.5 percent per year over the next thirty years, (a not too optimistic assumption), 9 of the 47 candidate projects which had been calculated as uneconomic under the assumption of no price change, would become economic. The benefits from enhancement would rise 20 percent.

C. Small Scale, Economic Development Projects

It has been agreed that a Salmonid Enhancement Program would have multiple social and economic goals. These goals are to some limited extent at least independent of one another and require specific policies to be designed for particular goal areas. For example, there is no doubt, that if the Fisheries and Marine Service built enhancement projects which were efficient in the national income sense, there would be some spillover benefits in terms of the broader social and economic goals of government. Such projects could produce fish for the Indian food fishery and at the same time employ Native People in the operating phase. It is not our view however that this is a sufficiently affirmative approach to the distributive goals of the Salmonid Enhancement Program. Recall that the goals which fall into this category are those which stress benefits for people in remote communities where there are limited alternative economic opportunities, benefits for Native People, and benefits for people who might otherwise be unemployed. Specific innovative policies and projects need to be designed to achieve these objectives.

The impact of specially-designed salmonid enhancement proposals on the regional development, Native People and employment goals of government, at this point, can be only a matter of speculation. The Economics Working Group intends to test the magnitude of such potential benefits by a pilot series of small-scale development projects. Since, in this part of the program, the goals of the Salmonid Enhancement Program overlap with the responsibilities of other government agencies, particularly Manpower and Immigration, D.I.N.A. and D.R.E.E., it is expected that a significant part of the required funding will come from existing government program commitments. Such alternate funding possibilities will be aggressively sought out. The Group has already helped prepare a number of conditional applications to use Canada Works funds. All the projects have been proposed for joint funding by Canada Works and DFE and at this point are conditional on the Salmonid Enhancement Program being given approval and also on Department personnel approving their technical merits.

5 Socio-Economic Impact of a Salmonid Enhancement Program Proposal

The purpose of this section is to discuss some of the potential social and economic impacts of a Salmonid Enhancement Program. By way of illustration there follows examination of the case whereby enhancement could roughly double the (average 1970-1974) salmon catch to about 50 million pieces.

A. The With-Without Criteria

The objective of analysing prospective salmonid enhancement plans should be to assess what the state of the nation would be "with" a particular plan compared to the state of the nation "without" the same plan.

The scenario "without" the Salmonid Enhancement Program is difficult to predict. Without any action it is predicted that natural salmonid production could be reduced by at least 30 percent by the year 2,007. However, since the 1950's this long-term downward trend in natural production has been offset by man's efforts in the areas of resource management, habitat maintenance and protection, access improvement and enhancement. On the one hand, it could be argued that even without a formalised Salmonid Enhancement Program, the everyday operating mandate of the Department of Fisheries and the Environment could continue to offset the inexorable downward trend in natural stocks. On the other hand, it is also possible to argue, and probably this is the more realistic argument, that Pacific Region managers have already run out of low-cost production and management options. Thus, without the major restoration effort proposed under the Salmonid Enhancement Program, total production might well start to fall off. Figure 1 illustrates that at present the industry

is barely above the breakeven point. Any reduction in the average salmon catch would be disastrous for the industry and could result in losses for many processors, accompanied by a call for a massive inflow of government subsidies. It should also be noted that the raw fish price is the largest component cost of processing salmon. Processing costs are small in comparison. The two items which are absolutely vital to the survival of the salmon industry are the maintenance and the cost of raw fish supplies, (Fig. 1).

For the purposes of evaluation and impact assessment, the Economics Working Group has assumed conservatively that the present baseline of stocks could be maintained "with" or "without" the Salmonid Enhancement Program.

B. The Salmon Industry in British Columbia

The salmon resource of British Columbia supports a commercial fishing industry and a recreational fishing industry.

The commercial salmon industry is a major industry in the Province of British Columbia. Gross wholesale revenues from the B.C. salmon industry average $140 million over the 1971-1975 period, reaching a peak of $222 million in 1973. Over the 1971-1975 period, roughly 50 percent of the wholesale revenues accrued to the primary (fishing) sector with the remaining 50 percent accruing to the secondary (processing) sector.

The salmon industry accounts for between 70 and 75 percent of the revenues for all fish and fish products landed by B.C. fishermen or processed in B.C. plants. Since the total fish and fish products industry in B.C. accounts for approximately 2.7 percent of the value added of (or total income generated by) all commodity-producing industries in B.C., it is clear that the salmon industry makes an important contribution to the income generated in the province.

With respect to employment, it is estimated there are 8,500 salmon fishermen in the primary sector, fishing between 40 and 60 days per year. The processing sector for all fish products employs approximately 3,400 workers of which approximately 2,500 could be said to be employed for the processing of salmon. The majority of salmon processing is in Prince Rupert and Vancouver. There are smaller facilities in Victoria, Port Hardy, Bella Bella and Masset. With respect to employment, it is estimated that approximately 1,100 people are employed in processing in Prince Rupert, 1,200 in Vancouver and the remainder in the other locations.

PROJECTED SALMON PROCESSING INDUSTRY COSTS

BASED ON 1974-1975 AVERAGE
PRODUCT MIX
MARKET VALUES
PRICES TO FISHERMEN
PROCESSOR FIXED & VARIABLE COSTS

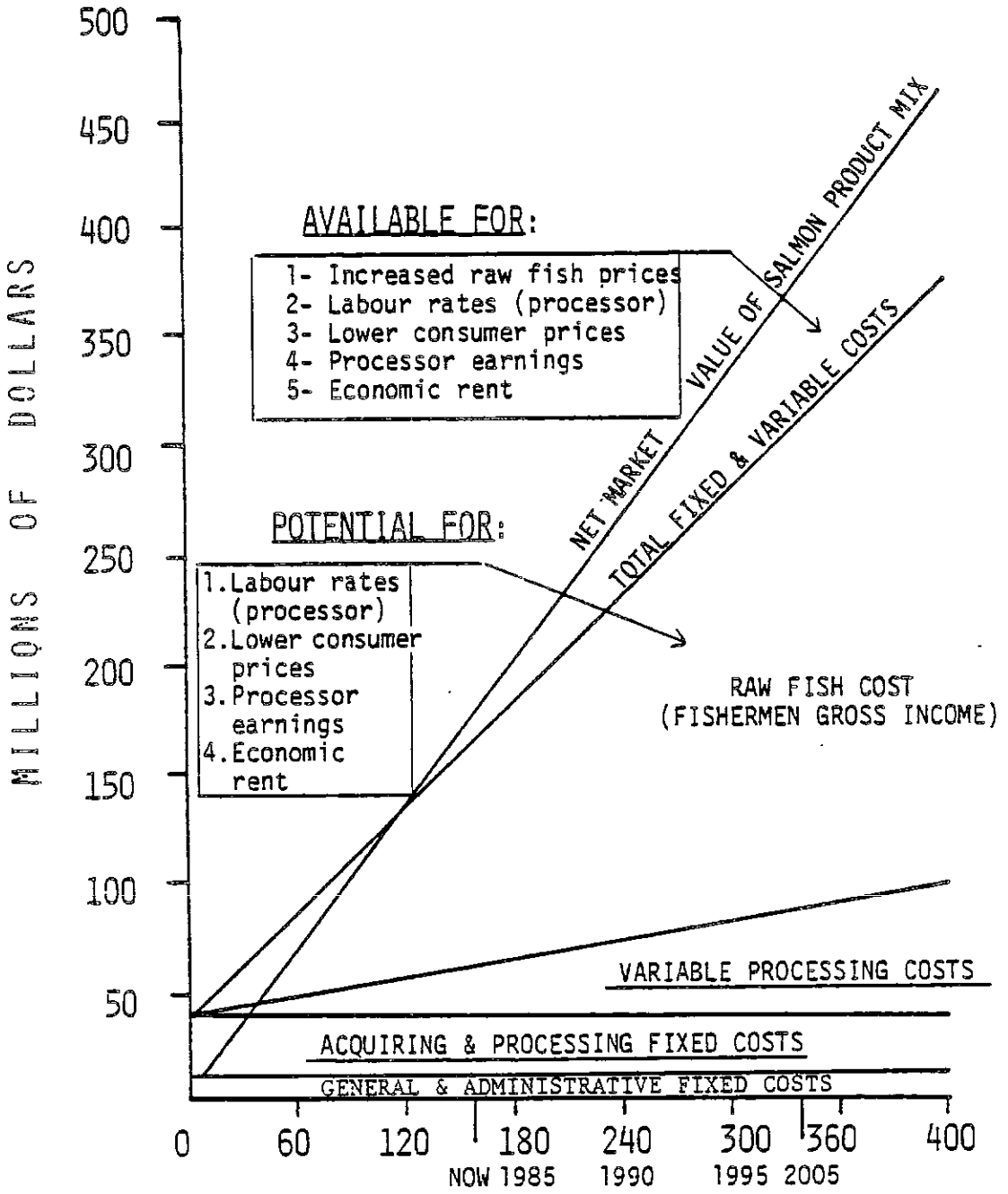

FIG. 1

INDUSTRY CATCH OF SALMON IN MILLIONS OF POUNDS

Native Indians are employed in processing in Prince Rupert, Masset and Bella Bella. In 1974, there were about 850 status Indian workers in Prince Rupert and Masset, and 50 in Bella Bella. It has been estimated that Indians, status and nonstatus, account for between 60 percent and 70 percent of total shoreworker employment in the northern areas. In addition, about 15 percent of all British Columbia commercial salmon fishermen are status Native Indians.

While the salmon industry is a major industry in B.C. both in terms of income and employment, it could not be characterized as a "healthy" industry. Despite efforts by the federal government to limit the number and size of vessels engaged in salmon fishing, the average returns to capital employed is still quite low. The fishing industry suffers from excess capacity, a situation clearly manifest in the primary sector, but evident in the secondary sector as well. It is in the context of this important, but low-return industry that the salmon enhancement program has been proposed. The problem of the existing excess capacity has been noted because it is critical in understanding the nature of the economic impacts of the program. This will be discussed in the Section on impacts that follows.

Although recreational fishing takes place throughout all of British Columbia, the sport fishing industry (that is, the resorts, marinas, charter boats, etc.) are concentrated primarily in the lower mainland and on the east coast of Vancouver Island. There are over 200 facilities catering primarily to anglers in addition to many other less specialized tourist facilities providing direct and related services to anglers.

In 1975, there were approximately half a million sport fishermen in British Columbia. Some 250,000 fished in salt water with one half fishing exclusively in salt water. Total angling expenditures on purchases directly related to sport fishing exceeded $100 million (approximately 10 percent of the Province's tourist expenditures). Employment in service industries attributable to sport fishing amounted to an estimated 3,500 full time jobs (5 percent of tourism related employment in the Province).

Tourism in British Columbia, with a yearly growth rate of 12 1/2 percent, is one of the fastest growing industries in the Region. Growth in recreational fishing has kept pace with the rapid growth in this sector. The stock of fish is only one component of the recreational fishery "product" but it is a critical one. Sport fishing is a very competitive industry and significant changes in the quality of the product could have major impacts on the various industries dependent upon this resource.

C. National Income and Employment Impacts

It is apparent from studies undertaken by the Economics Working Group that the illustrative salmonid enhancement program, outlined above, could have significant impacts not only in the salmon industry, but throughout the regional and national economies. Say, for example that enhancement by the year 2007 could increase the size of the catch by 25 million pieces and thereby increase total industry revenues by approximately $274 million ($156 million in the primary sector and $118 million in the processing sector). A large part of these revenue additions might take the form of increased income from exports. The increased revenue, in turn, could generate an increase in national income of $471 million. Of this increase about $231 million, or 49% might be derived from a direct increase of income in the salmon industry, the other $240 million or 51% might result from increases in income in other industries. Taking both the primary and processing sectors together, while the direct increase in employment from enhancement, when it has its full effect by 2007, might only be 0.83 million man-days, the total increase could be 4.32 million man-days for Canada as a whole (1.98 million for British Columbia). This is equivalent to the annual employment of 19,600 workers in Canada of whom 9,000 could be employed in the province of British Columbia. These increases in employment reflect opportunities in the commercial fishery and do not include employment gains that will be realized from a healthy sport fishery and increased tourism activity.

The principal source of the indirect impacts could be from the additional private spending associated with the increase in private incomes, and thus the industries which could benefit most from enhancement would be the consumer goods industries. One might have thought that the ramifying effects of enhancement would be felt most in the ship-building or electronics industries, in canning materials industries, in fuel industries, etc. This however, may not be the case because the salmon industry, with its existing excess capacity, does not require significant quantities of such operating and capital inputs in order to double its output.

From the perspective of government policy, public investments which improve efficiency are generally better than those which simply raise the level of economic activity because improved efficiency expands the output potential for the economy as a whole. Salmon enhancement is very attractive in that it offers both improved efficiency as well as impacts that could raise the level of economic activity. Nevertheless, in assessing the relative benefits of alternate projects, it is the efficiency effects which must be borne in mind. If projects or situations could be conceived whereby the impacts are larger, they are not necessarily better. A full cost-benefit analysis as opposed to an impact analysis must, of course, take this into account.

Concurrently, it is estimated that given increasing demand for salmon and steelhead resource based recreational fishing opportunities, an enhanced fishery could "effectively" support, by the year 2007, some 3 million new rod days, with annual incremental net benefits accruing to British Columbian and Canadian anglers, as a whole, in the order of $34 million. The connotation of "effective support" is here taken in a narrow yet acceptable sense of meaning the maintenance or improvement of existing quality as measured in terms of catch per unit/effort. Relevant factors considered in assuming an increasing demand, as well as the estimates of new rod days and incremental net benefits generated include demographic and socio-economic trends, consideration of the species and site specific nature of the individual projects, and the development of a simple stock-success-effort model.

Primary benefits include the generation of non-Canadian angler expenditures which, in the absence of maintaining or improving fishing quality, would not otherwise be forthcoming. Conversely, our foreign exchange position can be improved by encouraging Canadians, through maintaining or enhancing the quality of the product, to fish in Canadian waters.

Also of benefit to the economy would be growth in those parts of the service sectors which are directly related to the salmon sport fishery, and whose development would not otherwise be forthcoming. Illustrative of these types of investment which might be attributable in whole or in part to the enhancement program include growth in the accommodation sector, the charter or "party" boat industry, private wharves, guiding opportunities for native people, etc. It is projected that these resultant increments could account for an increase in national income, the extent of which is unknown at this time given available information. It is known, however, that the labour intensive tourist sector is one of the fastest growing in British Columbia and in Canada.

D. Regional Development Impacts

The total Salmonid Enhancement Program has been analyzed by D.R.E.E. specifically in terms of the geographical redistribution of gross returns to salmon fishermen. The analysis indicates that subject to some critical assumptions, the proposed Salmon Enhancement Program could have the effect of considerably raising the average level of gross returns to salmon fishermen along the B.C. Pacific coast, and that important geographic shifts in these levels could also occur between 1976, 1991, and 2006 respectively.

The two most critical assumptions are firstly that there will be no appreciable increase in the number of salmon fishermen, nor any change in their approximate numbers at the Fisheries Statistical Areas level of geographic detail. Secondly, there is the assumption that the percentage "takes" by fishermen operating out of each home port statistical area will remain the same for 1976, 1991 and 2006 as they were in 1975.

The coastal sub-region, north of the Bamfield to Powell River line, will experience the greatest improvement in both total gross returns and gross returns per salmon fisherman from 1976 to 1991 and 2006. This sub-region, that in 1976 had an average gross return of only 92 percent of the B.C. Pacific coast average, is expected to increase its average return to 103 percent in 1991 and 108 percent in 2006.

Average gross returns to salmon fishermen in the southern sub-region will decline relative to those in the coastal sub-region, from 1976 to 1991 and 2006, but due to the overall increase in total gross returns, fishermen in the southern sub-region will continue to have very respectable average figures in each of these years.

More than two-thirds of the expected improvement in gross returns to salmon fishermen, as a result of salmon enhancement will have taken place by year 15 of the program (1991). By this time most of the geographic shift in average gross returns will have taken place. By the year 2006 the spatial pattern of gross returns will be considerably different than in 1976, provided the assumptions in the analysis are borne out. The Johnstone Strait area (Statistical Areas No. 12, 13) and the Bella Coola area (No. 8) will have the highest average gross returns along the entire B.C. coast, with the exception of salmon fishermen operating out of Area No. 20, Sooke. Good average gross returns will prevail in the Prince Rupert and Powell River areas. Fair gross returns will accrue to fishermen in the Queen Charlottes and the north coastal as well as the west coast of the Strait of Georgia. Almost without exception, the poorest average gross returns will exist along the west coast of Vancouver Island north of Ucluelet.

In addition, income and multiplier impacts associated with the illustrative salmonid enhancement program were calculated by consultants at the sub-regional level. Three communities were chosen as individual case studies: Prince Rupert, Bella Bella, and Alert Bay. The total annual direct and indirect income impact arising from an increased salmon catch and more salmon processing activity by 2007 could be $26.07 million, $2.75 million, and $2.29 million respectively. Likewise, the annual increase in total employment could be 600,000 man-days, 16,760 man-days and 2,330 man-days respectively.

The size of the income and employment multipliers and the magnitude of the impact varies with the size and structure of the sub-regional economy. Of the three communities studied, Prince Rupert had the highest income and employment multipliers (1.23 and 2.8 respectively). Those for Bella Bella and Alert Bay were approximately 1.10 and 1.29. However, the relative impact is much greater in communities the size of Bella Bella and Alert Bay because their economic base depends almost entirely on fishing and related activities.

The greatest overall impact from the Salmonid Enhancement Program will take place in the more populated areas of British Columbia and the rest of Canada. Nevertheless, the direct plus indirect revenue impacts on small communities are substantial in relation to the size of their economic base. For example, in total, salmon enhancement by 2007 could mean $2.75 million to Bella Bella and 16,760 man-days of employment or 77 persons gaining full-time employment. Compared to the total income of Bella Bella residents in 1975-76 (est. at $2.9 million) and a current labour force of 400, the impact of the program could be substantial.

E. Native People Impact

The magnitude of potential income and employment impacts of the Salmonid Enhancement Program on remote Native Indian communities can be gauged from the discussion of regional impacts outlined in Section D above. The example of Bella Bella, one of the larger Native villages along the coast, was reviewed in that context.

In more general terms, the Salmonid Enhancement Program will contribute to the Native People Account through two principal types of benefits:

1. Those associated with the incremental fish - extra fishing income and employment, extra shoreworker income and employment.
2. Those associated with Native involvement and employment at specific enhancement projects.

In order to maximize benefits of the first type, projects could be located as much as possible, within the constraints of the economic criteria in the central and northern areas. Benefits of the second type can be pursued on two fronts:

1. A deliberate Salmonid Enhancement Program management strategy for fostering, in the short term and in the long term, the involvement and employment of Native people at enhancement projects.

2. Development of a program of small projects, conceived as economic development ventures, as outlined in Section 4.C. Projects should be initiated and managed by Native people, if possible. In the short term it is through such projects that Native people will most meaningfully be involved in the Salmonid Enhancement Program.

6 Social and Economic Research Needs

A. General: The Basic Elements of Planning

(i) Analysis of Existing and Future Supply

On-going research will be applied to supply estimates of salmonids and salmonid related services. The four dimensions of any supply estimate consist of quantity at any given point in time, quality at any given point in time, location and cost per unit of supply. Analysis of the supply side, in the process of plan formulation, has to consider the various available alternatives for improvement of total effective supply in terms of all four dimensions.

(ii) Analysis of Existing and Potential Demand

Existing studies of the markets in which salmon, in its many forms, is marketed, including studies undertaken specifically to evaluate the possible consequences of the proposed Salmonid Enhancement Program have been somewhat simple and partial in nature. For example, the analysis of commercial fish production does not consider - directly at least - the role of increased landings by countries other than Canada. Other external factors, such as technology, institutions and consumer preferences, have also largely been ignored to this point.

A more detailed econometric model has to be specified - one which would permit examination of expected impacts of salmonid programs in specific countries, involving individual species, and particular market forms. This would improve the quality of the forecasts, although uncertainty and errors will not be eliminated altogether. Simulation techniques should be applied to forecasting in order to analyse the sensitivity of the results, particularly benefits and costs, to the assumptions made. Furthermore, it will be necessary to continually upgrade demand forecasts over time so that new plan formulations and subsequent actions can be modified over time to adjust to new circumstances. This approach will also be useful in monitoring the Salmonid Enhancement Program as it unfolds, in order to minimise the likelihood of making irreversible decisions with high costs.

(iii) Plan Formulation

Given the estimates of available and potential supplies and for existing and future demand, plans can be formulated which best meet desired goals. In Section 2, the planning process to which the Economics Working Group aspires, was described in some detail. The tools of benefit-cost analysis, shadow pricing and trade-off functions between national income and non-national income benefits and costs can be employed to arrive at an optimal social solution. The application of these tools in the formulation of plans and programs has to be continually developed and upgraded. Efforts should be made to open up the economic planning process to interested client groups and, through the Public Involvement Program, to the public at large.

(iv) The Modelling of the West Coast Salmon Industry

The modelling of the west coast salmon industry is seen as a method of tying all the information being gathered by the Economics Working Group into a cohesive structure and a useful predictive tool. Present and future research into the industry's structure and efficiency, and market demand, as well as the biotechnical fish production model, will serve as inputs to the model. The model itself should be of a simulation type, capable of being updated as the quality of information improves and able to incorporate alternative management options.

(v) Monitoring and Evaluation

A system for monitoring the success of the Salmonid Enhancement Program in attaining its objectives, will have to be developed and implemented.

B. Specific Research in the Context of the Five Account System

(i) The National Income Account

Items which require further study include the following:

- the relationship among gear type, area of fish production and processed form of the end product.
- the impact of Salmonid Enhancement Program production levels upon the catching and processing capacity of the industry.
- test the commercial fishery benefit and cost assumptions against actual 1975 and 1976 production data, and thus refine estimates of waste factors, weight premiums and quality discounts.

- incorporate information from market demand studies into estimates of gross value.
- refine estimates of fishing and processing costs.
- optimisation of the allocation of the catch among user groups.
- examination of non-structural alternatives to proposed projects (management, pricing, etc.).
- further specify the relationship between fish abundance and the demand for sport fishing.
- examine the relationship between rod days and economic value.
- identify and differentiate the recreational fishery product and identify and categorize resource users according to their interests and by object of public policy.
- develop baseline information of the recreational fishing industry and its dependency on the fishery resource.
- develop marketing objectives and strategies including inter-agency relationships and opportunities.
- conduct "on site" recreation surveys to establish an empirical data base specific to site, time and species.
- improve information on the demand for the Indian food fishery.
- investigation of socio-economic and bio-physical interactions in watersheds leading to the determination of resource interaction costs associated with the Salmonid Enhancement Program.

(ii) The Regional Development Account

(iii) The Native People Account

(iv) The Employment Account

A program of further research is expected to emerge from the preliminary studies of the Salmonid Enhancement Program being carried out by D.R.F.E. by the Native People Impact Study Team and by the Employment Study consultant Preliminary reports in these areas are currently being completed.

In these three areas it is expected that the recommendation will be to put most immediate effort into :

(a) economic development pilot projects,
- to assist with getting such projects started; advise on project organization, management, personnel selection, training, etc.
- to develop and implement a system for monitoring these projects
- to troubleshoot during operation
- and to prepare evaluation reports;

(b) carrying out economic and social impact assessments for standard enhancement projects begun during 1977/78, in terms of the Regional Development, Native Impact, and Employment goals of the Salmonid Enhancement Program; and,

(c) monitoring on an on-going basis the social and economic baseline conditions and developing mechanisms through which project selection criteria can maximise benefits on these accounts.

These research areas, which are primarily operational, will be most critical in determining whether Native People involvement, remote community involvement and otherwise unemployed people involvement in the Salmonid Enhancement Program is a success. They are also the areas which must be handled very carefully and which will require a great deal of time and effort to implement properly.

(v) The Environmental Account

Present studies on the appropriate designation and weighting of decision criteria have been recognised as preliminary. This whole area needs further work in order to be able to priorise projects which are being recommended for construction on the basis of Environmental Account benefits.

7 Policy Issues

A. Rent Generation and Cost Recovery in the Commercial Fisheries

(i) Introduction

The Salmonid Enhancement Program presents an opportunity to provide substantial benefits to those engaged in the salmon fishing industry of British Columbia. The Canadian government may wish to collect revenues from the direct beneficiaries of the program to help pay for the sizeable investments required by the program. The consequence of not recovering costs would be the distribution of sizeable windfall gains to a few fishermen and processors at public expense.

In general, fisheries resources are potentially capable of generating considerably increased income from enhanced catches, so that a surplus remains even after catching and processing costs have been taken from the selling value of fish products. This residual, known as rent, could accrue to the owner of the resource - in this case, the Canadian public. The amount of resource rent present in a fishery during any time period depends upon the value of final products and the amount of other resources used in catching and processing. When there are insufficient restrictions on the amount of other resources employed in the fishery, however, the rent will approach zero. This occurs because of the "common property" nature of the fisheries resource. Competition among fishermen and processors for a fixed stock of fish could mean that rent is dissipated as returns to redundant labour and capital.

In considering the potential for economic rent to accrue from the fishing industry, it is important to realize that some effort on the part of government to restrain the entry of additional but redundant capital or labour may be necessary. This issue is further developed in Sections (B) and (C) below.

(ii) Cost Recovery Potential of the Salmonid Enhancement Program

Preliminary economic analysis of the project alternatives for Phase I of the proposed Salmonid Enhancement Program indicates the potential for a substantial fish production increase over a number of years. By way of example, a hypothetical program was constructed based on the cost and output characteristics of projects in rank class 1 or 2 in Table 2. This program was scaled to produce in the order of 10 million fish by year 10 and 23 million fish by year 20 of the program. The forty year stream of gross commercial benefits from such a program would yield a present value of some $930 million (at 10% discount rate). The present worth of all capital and operating costs for the same program would be $250 million.

Consultant studies and industry interviews during 1976 have indicated that, in general, there is sufficient existing capacity in the fishing industry in B.C. to catch and process more than double the present runs. Consequently, if this is the case, the only incremental costs necessary to harvest the fish runs at this scale of enhancement are the variable costs - labour, fuel, supplies, etc. In short, provided that industry is appropriately disciplined to prevent further unnecessary and inefficient investment in capacity, the commercial associated costs will amount to only the increased variable costs of harvesting and processing. The resource rent, which could thus be potentially generated by this hypothetical version of the Salmonid Enhancement Program, would be as follows:

Gross Benefits	$	930,000,000
Associated Costs	$	300,000,000
Resource Rent	$	630,000,000

The flow of annual government investment expenditures and resulting industry net revenues is depicted in Figure 2. During Phase II (years 5 to 15) industry net revenues overtake government outlays, thus allowing for full cost recovery.

It becomes clear, therefore, that if investment behaviour can be controlled, then the program can generate enough commercial fishery net revenues ($630 million) to more than adequately cover all the program costs ($250 million). The actual figures may vary from this illustration with somewhat different phasing of the program. However, this example program demonstrates the potential for government cost recovery in an enhancement program designed in an economically efficient way. There also seems to be enough latitude within such a program to ensure not only the recovery of public investment costs but also the pursuit of a program design which puts a balanced emphasis on the non-national income goals of government.

B. Fleet Size Policy Issues

i) Introduction

The traditional economic problem regarding fisheries management has been how to control fishing efforts in order to prevent the erosion of resource rents by excessive and inefficient fishing activity. Because of the common property nature of the fisheries resource, there has been a widely recognized tendency to overinvest in the industry, leading to low average returns.

S.E.P. GOVERNMENTAL INVESTMENT (-)

- VS -

INDUSTRY INCREMENTAL NET REVENUES (---)

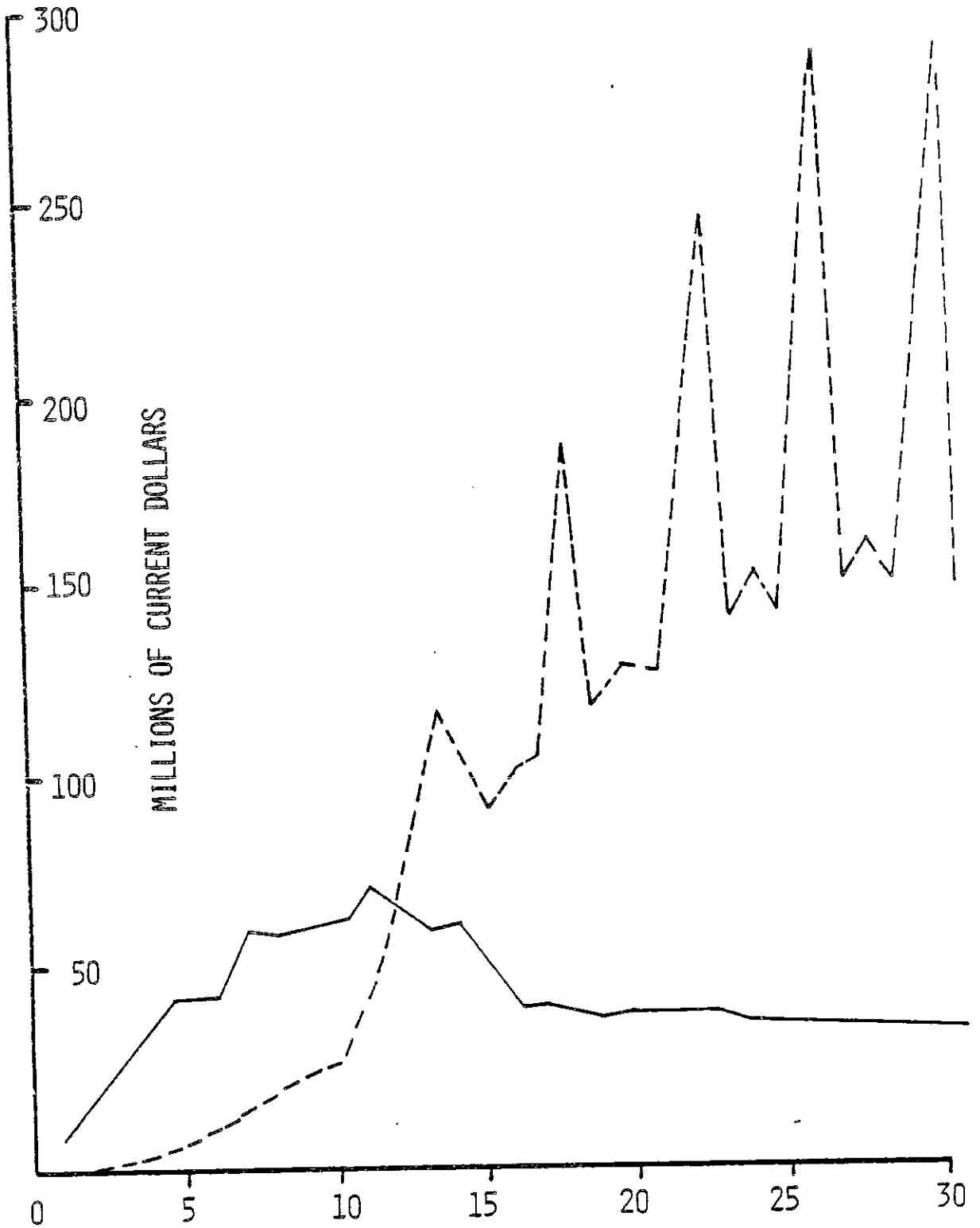

FIG. 2

It is in the context of this situation that the policy questions arising from the Salmonid Enhancement Program must be addressed. These policy questions are as follows:

1. Given the present excess capacity, is there sufficient capacity to catch the enhanced quantities of fish without further investment?

2. Given the historic tendency to overinvest, what investment regardless of requirements can be expected as a result of enhancement and how can this be controlled?

These two questions relate to the need for, or the likelihood of, investment as a result of enhancement. The issue of investment is important because it can affect the increase in costs associated with the increase in output. If investment in new vessels or equipment is required, then the net benefits from enhancement would be correspondingly lower. If investment takes place regardless of requirement then while the potential net benefits from enhancement would not be reduced, the actual benefits would be, as the overinvestment dissipated the resource rents.

(ii) Existing Fleet Capacity and Requirements with Enhancement

In the series of industry structure, efficiency and cost studies prepared by U.M.A./Edwin Reid, it was conservatively estimated that the present number and mix of salmon vessels could harvest an average of 7.85 million pounds of fish per day. During short peak periods, it was estimated that the daily harvest could in fact be substantially more. Thus, the current fleet would have the capability of harvesting the increased quantities of fish at the scale of the illustrative enhancement program which would double the (average 1970-74) catch. By the time this enhancement program had its full effect (year 30), the catch would have increased to an average of 335 million pounds per season, with peak years of about 450 million pounds per season. These quantities could be caught by the fleet at the average 7.85 million pounds per day, operating four days per week for 11 and 16 weeks respectively, well within a June through September season.

With respect to peak requirements one must bear in mind that the weekly capability during the peak period could be significantly above the seasonal average, firstly, because of the ability over short periods to catch more than the average daily capacity, and secondly, because fishing could proceed for more than four days per week during the peak period. Thus the fact that present fleet capacity is sufficient to harvest the fish over the season would also suggest that peak capability would also be sufficient for peak requirements.

(iii) Investment Behaviour

A major lesson of the west coast salmon licencing program (1969) has been that the control of the number of vessels is not the same as the control of investment. Despite the licencing program, considerably more money has been invested in the fleet since 1969. This investment has been in the form of replacement vessels or more sophisticated equipment on existing vessels.

The peak year of 1973 illustrates the levels of investment that can result from an enlarged catch. Following that catch the number of new vessels replacing old vessels more than doubled. Licence statistics indicate that there were almost 200 new (replacement) vessels in 1974 as compared to less than one hundred every other year in the 1970's. Also the number of vessels with new more sophisticated equipment increased.

In order that potential resource rents from enhancement not be disipated by overinvestment, it will likely be necessary to devise further methods of control.

C. Processing Capacity Policy Issues

(i) Introduction

The basic question regarding processing capacity is whether there is presently sufficient capacity in British Columbia to process the additional fish from enhancement. The answer to this is critical in assessing the economics of enhancement as it can affect the total increase in costs associated with the increase in output.

The adequacy or sufficiency of existing capacity depends on (1) where the fish is processed; (2) how it is processed; and (3) when it is processed. To some extent these factors are affected by the choice of enhancement developments - where the developments are located and what species of fish are produced. Thus, the question of sufficiency must be recognized

as not simply an exercise in comparing unalterable numbers, but also as a policy question of how the selection of developments can be made to improve the likelihood of existing capacity being sufficient.

The concern regarding the sufficiency of existing capacity is, as noted above, because of its critical role in assessing the economics of enhancement. Underlying this is the assumption that if existing capacity is adequate, then no new investment will be undertaken in response to the increase in output.

In the context of this industry, however, it is not clear that this assumption is realistic. One must ask whether the forces which gave rise to the current excess capacity might also maintain the excess capacity in the future, or in other words, again push investment in facilities beyond what is required. Thus, there is another policy question: what measures, if any, must be taken to ensure that even if capacity is sufficient, there is no "unwarranted" or "uneconomic" investment in new facilities.

(ii) Processing Capacity Requirements with Enhancement

In the series of industry structure, efficiency and cost studies prepared by U.M.A./Edwin Reid, it was estimated that peak week production as a result of enhancement would be expanded approximately 129% in the north and 92% in the south. This, they noted, would likely create the need for additional freezing facilities in the north, particularly if their lower capacity estimate is correct. It could also create the need for additional canning lines in the south, again particularly if their lower capacity estimate is correct (and also if there isn't the expected 20% capacity improvement from more efficient operations).

From the point of view of efficient capacity utilization, the figures in the U.M.A./Edwin Reid analysis clearly suggest that enhancement developments which are likely to generate more canning production in the north and more freezing production in the south are better than developments which generate more freezing in the north and developments which generate more canning in the south. Such an emphasis would reduce the likelihood of requiring additional processing capacity as a result of enhancement.

These considerations would suggest (other things equal) that in the northern areas, it would be better to enhance relatively more sockeye and pink than chinook, coho and to a lesser extent chum. In the southern areas, it would be better to enhance relatively more chinook, coho and to a lesser extent silver bright chum and pink, than sockeye. In this way, one would be minimizing the expected incremental processing capacity costs associated with a full scale enhancement program.

(iii) Industry Investment Behaviour

Investment in new capacity ideally should only be made when the new facilities provide the least cost means of processing the fish. Unless new processes are available which would sharply reduce variable costs, new investment should not be made unless the existing industry capacity is fully utilized.

In an oligopolistic industry such as B.C. salmon processing, one cannot expect that the ideal or optimal investment rule would be followed. Investment by firms in this industry is not solely a means of satisfying production requirements, but is also a weapon used in the competitive struggle with the other members of the industry and potential new entrants.

The more capacity a firm has, the greater is its chance of obtaining a larger share of the catch for processing. The greater the firm's share of the catch, the more price control can it exercise over the market for the raw fish. In this context, a large firm would not want to wait until additional capacity in the industry was needed for fear of being pre-empted by a rival. Even if the firm's production would not suffer by being pre-empted, its relative share and therefore position of control would eventually suffer.

Vis-a-vis potential new entrants, excessive investment which produces excess capacity serves an important role of discouraging entry. The potential entrant recognizes that the existing firms with the excess capacity could and likely would outbid the new entrant, preventing the new entrant from achieving its necessary share of the catch. The purpose of discouraging entry is again to maintain better control over the industry.

The point here is that investment may well proceed beyond that which is necessary as a result of enhancement. Investment to achieve size and locational advantages in order to capture larger and more dominant shares of the market are quite possible.

D. Economic Rent Generation and Cost Recovery in the Recreational Fishery

(i) Potential Rent Generation

Economic rent can accrue to owners of resources which, in the case of the Pacific salmon fisheries, consist of the people of Canada. A theoretical framework has been developed for examining economic surpluses (producers, consumers and resource rent) and the means of optimizing these either individually or in combination. Rent generated in the open-access free-entry sport fishery in our Pacific tidal waters (excluding the U.S. boat licence) accrues solely to anglers, who now pay nothing for the right to fish.

Revenue generation potential of a sport fishery can be inferred from the consumer surplus. By taking the midpoint of the estimated range of willingness to pay for an angler day ($15 in the case of the B.C. tidal water fishery), one can multiply total angler days in the tidal sport fishery (3,000,000) by $15 and arrive at an estimated annual consumer-surplus based value of the fishery of $45 million.

(ii) Cost Recovery Mechanisms

In line with various precedents for a "user pay" policy which have been emerging in kindred areas of federal operations (e.g. National Parks), anglers, as beneficiaries of SEP, should be required to pay. However, there are both theoretical and practical problems associated with cost recovery.

A primary problem is the definition of cost. Should it include only budgetary outlays of the Service, or also the costs of other federal and provincial agencies as well as opportunity costs? Some practical aspects of costs are equally difficult. For example, what portion of the following should recreational fisheries bear: fisheries research costs, the joint costs of multiple use fisheries facilities, and the operational costs of general fisheries protection?

While reasonable assumptions can be made for the foregoing, there is a whole area of public policy questions related to what is an appropriate level of cost recovery, taking into account the nature of the output, the consumers involved, and the contribution being made to the country through tourism.

Given answers to the foregoing, it is useful to look at the avenues for cost recovery under two headings, direct and indirect.

Looking first at the latter, the indirect avenues of cost recovery consist of both the recreational fishery support industry and what can be called the associated industry. The support industry is made up on those businesses providing direct access services to anglers i.e. charter boat operators, rental boat operators, guides and guide services, fishing lodges, sport fish canneries and fishing gear and bait outlets. Notably, these are the kinds of businesses that depend on sport fishing and would suffer most, if not disappear, if angling decreased or disappeared. At the head of the foregoing list are those businesses which could pay fees, or could be taxed, in relation to the volume and/or value of the services they provide to anglers.

A base for cost recovery from the so-called associated industry is far less clear. This group consists of the marinas, boating services, motels, hotels and restaurants and various travel related and carrier services which add up to a substantial share of anglers' costs of fishing. The problem is, however, that while many of these businesses would suffer due to the decline in volume or value of fishing, they all generally provide other services and have consumer revenue from other than anglers, although the economic dependency on the sport fishery of many of these establishments varies from incidental to almost complete.

Unlike the commercial fishery, none of the foregoing businesses can either own or sell the sport fishery property right -- i.e. the right to fish. In the commercial fishery, by contrast, the fisherman catches the fish and renders it thereby into a commodity (property) which passes, as such, through successive stages of ownership and upgrading until it is finally sold as a physically owned piece of "property", or good, to ultimate consumers. The authority to permit and/or sell access to anglers is exclusively vested with the federal government in the case of tidal sport fisheries, and thus direct cost recovery can only be effected through the pricing of access by FMS.

(iii) Present Status of Tidal Sport Fish Licencing

It became apparent in the early planning stages of the SEP that the recreational fishery could be a major beneficiary. However, in the absence of a tidal licence system, little was known in an overall sense with respect to the actual dimensions of that sport fishery beyond estimates of salmon catch and effort. The sport fishery was recognized as important but the specifics respecting its actual role and potential were lacking.

Fortunately, dedicated anglers are prototypal consumer advocates, and organized anglers have for years been on record as favouring tidal licencing to both substantiate their interest in the resource and to enable their views to be taken into account.

Following extensive consultations, organized anglers have agreed to support licencing for two basic reasons: first, to "legitimatize" their status and provide tangible evidence of their support for SEP in principle, and second, to provide the information base to enable the sport fishery to be put into perspective and better managed and developed in keeping with its potential. In the process of these consultations with organized anglers, it was agreed that besides the straight costs of licencing administration, enough revenues should be generated from licencing to make a contribution to specific sport fisheries enhancement.

One major problem exists with respect to non-Canadian licencing: specifically, the adverse impact that the introduction of a realistic non-Canadian licence fee could have on tourism generally, and especially on the support industry which is highly vulnerable to U.S. angler reactions to the rising levels of costs they are encountering on the British Columbia coast. Thus, no precipitate action would be taken in this matter without further consultations and a full assessment of the impact of any decision.

Linked with non-Canadian fees is a final decision as to what should be done with respect to the existing non-Canadian boat licence. It is clear that some U.S. based charter operations are carried out in Canada, and that many of the U.S. boats are provisioned and used in ways considered detrimental to both Canada and the Canadian support industry.

Licencing serves many purposes, i.e. defining the tidal angler constituency; providing a flexible marketing and control tool for managing fishing - in its broadest sense; enabling better regulation; serving as a direct revenue source; and providing an information base for developing information on angler effort, catch, characteristics, motives, interests, expenditures, investment and intentions. Implicit in these are the two primary purposes mentioned earlier, whereby anglers establish and legitimize their voice, and at the same time provide a base whereby their interests in fisheries enhancement can finally be ascertained and reflected in overall management in the public interest.

Finally, tidal sport fish licencing relates to S.E.P. and the development, management and realization of the fishery potential. As well, firm conclusions respecting the form of non-Canadian licences and the fee structure should be a matter of continuing consultation in the interests of all concerned .

E. Other Policy Issues in Recreational Fisheries

It is generally thought that increases in the numbers of sport fish available increase the value of the sport fishery. However, in a predictive sense, the relationship is far from being clearly fixed, or necessarily transferable from one specific set of circumstances to another (i.e. angler composition, numbers, interests, nature of the site, fish characteristics, size, gear that can be used, season, etc.).

Most consumers today are accustomed to having improvements in the quality of products and services both old and new brought to their attention. If soundly based, this type of information, or advertising, performs a useful function for producers, consumers, and society, as a result of the greater value subsequently perceived and quite often generated and paid for. In relation to the Pacific salmon tidal sport fisheries, there are countless opportunities for product differentiation (sites, species, sizes, numbers of anglers permitted, related amenities, etc.) which if effectively developed, managed, explained and promoted, could add very substantially to the perceived value of the fisheries. In many instances such improved "opportunities" could be established with relatively little added supply or enhancement costs.

In other instances, the cost would be substantial, but could still be justified given the willingness of many anglers to pay for just such unique or especially rewarding experiences. In short, this type of product development and differentiation opens up the opportunity for price discrimination and market segmentation. Obviously there would have to be a commitment to appropriate pricing of access to such sites, i.e. full fledged marketing management. Whether this is determined to be desirable is a matter of opinion -- but there is little doubt that these are world -recognized management avenues for upgrading and realizing upon fisheries potential. And they are, of course, part of what must be considered if any serious appraisal is made of the socio-economic potential value of the resource for recreation.

The organizational capability and focus to visualize the foregoing recreational fisheries potential, to build the information base for understanding the fishery, and to ultimately achieve this potential needs development.

F. Resource Use Interactions

Salmonid Enhancement developments have the potential for engaging a series of resource use interactions which should be accounted in the evaluation of projects and certainly should be given attention in planning beyond the stage of evaluation. Typically these interactions have been thought of in terms of resource use conflicts but it is clear that there may be complementary use of other resources with salmonid enhancement development. Both conflicts and complementary resource use will likely be identified and evaluated by the provincial (B.C.) government's land use planning procedures.

Resource use interactions can potentially take place between any combination of users of land and water resources. In recognition of the fact that most coastal waterways at present produce salmon, there presently exists a set of guidelines and regulations respecting land and water use designed to protect the habitat of salmon. Thus, any net value lost due to curtailment in scale of development, or higher cost of development of other resource uses caused by an enhancement project would have to be (i) directly attributable to the enhancement development; (ii) additional to the curtailment or higher costs which would result from application of the existing development guidelines. The same principle also applies to the beneficial effects of enhancement developments.

Two dimensions of the resource interaction issue are the evaluation of the interaction costs and benefits, and attempts to alleviate the severity of conflicts or to enhance or establish complementary use where possible. The approach to evaluation is to assess development of the watershed with and without the fisheries

project installed. The difference between the net development benefits with and without the project is then attributed to the fisheries project and is added to the costs or benefits of that project. This process will insure that only incremental effects of the enhancement development on other resource uses will be attributed to the projects under evaluation. Such external costs or benefits will be incorporated directly into the National Income Account as part of the full resource cost of a proposed project.

Resource development interactions will be of varying degrees of severity depending upon a large number of circumstances among them the scale of the developments, geographical location, topographic features of the location, and so forth. It therefore seems reasonable to classify interactions according to their severity be it minor or major. An assessment of the degree of resource interaction will be obtained through the evaluation process described above. The appropriate level of planning should be apparent from this analysis.

Minor negative interactions are very likely to be dealt with simply through the ordinary application of guidelines and regulations presently in existence or under development within governmental agencies at all levels reinforced by a simple referral process. An example of such a case might be the determination of the adequacy of privys, septic tanks or sewer systems to maintain health standards and water quality in, say, a recreational subdivision development. Depending upon the location of such a development the determination would be made according to the policies of a municipality or regional district or the provincial government.

Major developments involving large scale and/or a broad range of resource uses can be handled by the Provincial Working Group on Salmonid Enhancement struck under the auspices of the Provincial Cabinet's Environment and Land Use Committee. This Working Group is empowered to conduct studies and collect information for presentation to the Committee. All Ministries having interest in a particular development are represented on the Working Group. Based upon studies conducted by the Working Group, its internal discussions and representations made to it by the departmental members, the Working Group will attempt to achieve agreement on the planning aspects of the particular salmonid enhancement development. In the event that unanimity cannot be achieved or if the Working Group finds that a project is rendered uneconomic by the external costs of the development, the problem will be referred to the Environment and Land Use Committee.

In addition, of course, each enhancement project will be subject to review under the federal "Environmental Assessment and Review Process". Where required, impact studies will be carried out and reports will be submitted in the same manner as that of any other development proponent using federal funds or federal lands.

TABLE 1

CANDIDATE LIST OF PROJECT PROPOSALS
FOR PHASE I (YEARS 1 - 5) OF
THE SALMONID ENHANCEMENT PROGRAM

Project	Type	Location	Species	Maximum Annual Output ('000 pieces)	Construction Cost (1976 $'000)	Annual Operating Cost (1976 $'000)
1. Great Central	Lake Fertilization	W. Coast Van. Is.	Sockeye	519	0	69
2. Big Qualicum	Spawning Channel	Georgia Strait	Chum	300	1,655	158
	Rearing Pond		Coho	50		
3. Kennedy	Lake Fertilization	W. Coast Van. Is.	Sockeye	505	0	71
4. Nitinat	Box	W. Coast Van. Is.	Chum	300	2,088	238
5. Squamish	Side Channel	Georgia Strait	Chum	150	2,062	94
			Pink	200		
6. Long	Lake Fertilization	Rivers - Smith	Sockeye	150	0	138
7. Little Qualicum	Spawning Channel	Georgia Strait	Chum	200	1,804	194
8. Kemano	Spawning Channel	Kitimat-Kemano	Chum	600	7,164	604
	Hatchery		Coho	100		
			Chinook	25		
9. Henderson	Lake Fertilization	W. Coast Van. Is.	Sockeye	212	0	57
10. Vedder-Chilliwack	Spawning Channel	Fraser River	Chum	200	1,942	167
11. Puntledge	Hatchery/ Colonization	Georgia Strait	Coho	130	3,496	376
			Chinook	75		
			Steelhead	11		
12. Hobiton	Lake Fertilization	W. Coast Van. Is.	Sockeye	109	0	61
13. Inches	Box	Fraser River	Chum	100	448	124
			Coho	20		
14. Tlupana	Box	W. Coast Van. Is.	Chum	200	1,544	170
15. +Ankwil	Spawning Channel	Fraser River	Sockeye	2,120	8,668	328
16. Deadman	Rearing Pond	Fraser River	Coho	40	898	127
			Chinook	5		
			Steelhead	2		
17. Kakweikan	Fishway	Johnstone Strait	Pink	100	753	19
18. Embley	Fishway	Johnstone Strait	Pink	100	239	19

Project	Type	Location	Species	Maximum Annual Output ('000 pieces)	Construction Cost (1976 $'000)	Annual Operating Cost (1976 $'000)
19. Cowichan	Box	Georgia Strait	Chum	50	946	159
20. Blaney	Box	Fraser River	Chum	50	206	88
21. Birkenhead	Box	Fraser River	Coho	15	634	92
			Chinook	9		
22. San Juan	Rearing Pond	W. Coast Van. Is.	Coho	50	806	125
			Chinook	15		
23. Kitimat	Hatchery	Kitimat-Kemano	Coho	200	8,116	592
			Chinook	75		
			Steelhead	5		
24. Wolf Lake	Box	Georgia Strait	Pink	100	982	179
25. Nechako	Hatchery	Fraser River	Chinook	30	1,146	245
26. Mathers	Box/Spawning Channel	Q.C.Is.	Chum	80	1,262	410
27. Kalum	Hatchery	Skeena	Coho	150	6,436	411
			Chinook	60		
			Steelhead	5		
28. Babine	Hatchery	Skeena	Coho	110	5,464	443
			Chinook	70		
29. +Tschie	Spawning Channel	Fraser River	Sockeye	6,250	10,360	222
30. Vedder-Chilliwack	Hatchery	Fraser River	Chum	400	15,027	931
			Coho	700		
			Chinook	42		
			Steelhead	2		
31. +Harrison	Spawning Channel	Fraser River	Pink	1,800	2,504	180
32. Nimpkish	Spawning Channel	Johnstone Strait	Chum	350	3,710	249
33. +Horsefly	Spawning Channel	Fraser River	Sockeye	1,530	5,062	136
34. Nimpkish	Lake Fertilization	Johnstone Strait	Sockeye	200	0	55
35. Stave/Squakum	Box/Channel	Fraser River	Chum	300	1,560	263
36. Glendale	Spawning Channel	Johnstone Strait	Chum	200	5,365	301
			Pink	300		
37. +Vedder-Chilliwack	Spawning Channel	Fraser River	Pink	1,100	3,530	213
38. Harrison	Box	Fraser River	Chum	200	784	129
39. Ahnuhati	Spawning Channel	Johnstone Strait	Chum	200	1,110	244
40. Lowe Lake	Fishway	Kitimat-Kemano	Sockeye	140	409	6
41. +Nadina	Spawning Channel	Fraser River	Sockeye	3,190	7,948	184
42. Harrison	Hatchery	Fraser River	Chinook	250	7,040	523

Project	Type	Location	Species	Maximum Annual Output ('000 pieces)	Construction Cost (1976 $'000)	Annual Operating Cost (1976 $'000)
43. +McKinley	Spawning Channel	Fraser River	Sockeye	640	1,890	83
44. Kitimat	Spawning Channel	Kitimat-Kemano	Chum	250	1,665	145
45. Bella Coola	Spawning Channel	Central Coast	Chum	140	885	140
46. +Pitt	Spawning Channel	Fraser River	Sockeye	82	382	85
47. Toquart	Box	W. Coast Van. Is.	Chum	100	784	134
48. Ain/Naden	Lake Fertilization	Q.C. Is.	Sockeye	40	0	53
49. +Barriere	Spawning Channel	Fraser River	Sockeye	475	1,568	77
50. Deserted	Spawning Channel	Georgia Strait	Chum	100	1,110	219
51. Undesignated	Lake Fertilization	W. Coast Van. Is.	Sockeye	50	0	57
52. Green Inlet	Box	Central Coast	Chum	100	943	185
53. Ain	Spawning Channel	Q.C. Is.	Chum	200	2,817	181
54. Kainet	Box	Central Coast	Chum	75	916	170
55. Nicomen Slough	Box	Fraser River	Coho	20	118	23
56. Kakweikan	Spawning Channel	Johnstone Strait	Pink	400	4,325	264
57. Cowichan	Spawning Channel	Georgia Strait	Chum	150	850	106
58. Undesignated	Lake Fertilization	W. Coast Van. Is.	Sockeye	30	0	46
59. Khutzamateen	Box	Nass	Pink	75	916	43
60. Kwatna	Box	Central Coast	Chum	80	942	170
61. Khutzemateen	Box	Nass	Chum	80	943	170
62. +Upper Adams	Spawning Channel	Fraser River	Sockeye	75	590	107
63. Birkenhead	Rearing Pond	Fraser River	Coho	15	461	96
			Chinook	9		
			Steelhead	2		
64. Nicola	Rearing Pond	Fraser River	Coho	30		
			Chinook	15	1,354	145
			Steelhead	2		
65. Toon	Box	Nass	Pink	75	916	83
66. Moricetown Falls	Fishway	Skeena	Sockeye	5	143	5
			Chinook	2		
67. Chuckwalla	Hatchery	Rivers - Smith	Coho	150	3,137	353
			Chinook	30		
68. Coquitlam	Box	Fraser River	Chum	50	420	103
69. Bella Coola	Hatchery	Central Coast	Chinook	40	6,445	493
			Coho	200		
70. Bessette	Rearing Pond	Fraser River	Coho	30	420	113

Project	Type	Location	Species	Maximum Annual Output ('000 pieces)	Construction Cost (1976 $'000)	Annual Operating Cost (1976 $'000)
71. Little Qualicum	Rearing Pond	Georgia Strait	Steelhead	1	115	40
72. Toba-Jervis	Box	Georgia Strait	Pink	200	628	179
73. Sarita	Hatchery	W. Coast Van. Is.	Chum	200	9,334	516
			Coho	150		
			Chinook	50		
			Steelhead	2		
74. Toon	Box	Nass	Chum	60	943	170
75. Wannock	Box	Rivers - Smith	Chum	80	1,124	187
76. Kwatna	Hatchery	Central Coast	Coho	100	1,725	300
77. Kakweikan	Hatchery	Johnstone Strait	Chinook	30	1,200	244
78. Chilko-Chilcotin	Rearing Pond	Fraser River	Chinook	10	663	117
			Steelhead	10		
79. Kemano	Spawning Channel	Kitimat-Kemano	Pink	200	2,497	169
80. Yakoun	Hatchery	Q.C. Is.	Coho	140	2,758	345
			Steelhead	5		
81. Babine	Spawning Channel	Skeena	Pink	200	3,641	202
82. Wannock	Hatchery	Rivers - Smith	Chinook	40	1,639	267
83. Tete Jaune	Hatchery	Fraser River	Chinook	50	1,839	274
84. Copper	Hatchery	Q.C. Is.	Coho	70	1,238	274
85. Coquitlam	Hatchery	Fraser River	Coho	150	3,480	378
			Steelhead	2		
86. Eagle	Hatchery	Fraser River	Chinook	50	1,839	273
87. Morice	Hatchery	Skeena	Coho	150	6,296	511
			Chinook	60		
			Steelhead	5		
88. Lowe Lake	Hatchery	Kitimat-Kemano	Coho	50	1,249	275
89. Cottonwood	Hatchery	Fraser River	Chinook	50	1,839	281
90. Squamish	Hatchery	Georgia Strait	Coho	50	5,163	324
			Chinook	45		
			Steelhead	1		
91. Stuart	Hatchery	Fraser River	Chinook	50	1,839	274
92. Quinimass	Spawning Channel	Nass	Pink	150	3,710	207
93. Deena	Spawning Channel	Q.C. Is.	Pink	100	2,535	172
94. Kwatna	Spawning Channel	Central Coast	Pink	200	4,906	239
95. Kitimat	Spawning Channel	Kitimat-Kemano	Pink	350	6,132	389

Project	Type	Location	Species	Maximum Annual Output ('000 pieces)	Construction Cost (1976 $'000)	Annual Operating Cost (1976 $'000)
96. Cranberry	Hatchery	Nass	Coho	150	6,296	381
			Chinook	60		
			Steelhead	5		
97. Quesnel	Hatchery	Fraser River	Chinook	100	4,266	389
98. Yakoun	Spawning Channel	Q.C. Is.	Pink	400	7,076	376
99. McGregor	Hatchery	Fraser River	Chinook	100	4,266	389
100. Kispiox	Spawning Channel	Skeena	Pink	200	3,606	270
101. Nitinat	Hatchery	W. Coast Van. Is.	Coho	100	6,342	516
			Chinook	50		
			Steelhead	2		
102. Quaal	Spawning Channel	Kitimat-Kemano	Pink	250	6,120	275
103. Atnarko	Spawning Channel	Central Coast	Pink	500	8,702	349

* production every 2nd year only
** production every 4th year only
\+ International Pacific Salmon Commission Projects - could go ahead on the assumption that the interception problem is resolved.

TABLE 2

CANDIDATE LIST OF PROJECT PROPOSALS FOR PHASE I (YEARS 1 - 5)
OF THE SALMONID ENHANCEMENT PROGRAM

A. PROJECTS FOR WHICH DETAILED ECONOMIC ANALYSIS HAS BEEN UNDERTAKEN.

NATIONAL INCOME ACCOUNT (1976 $'000 P.W.)

Project	Capital and Operating Costs	Associated Costs[2]	Resource Interactions	Total Costs		Commercial and Indian Food Fish Benefits	Recreational Benefits[3]		Total Benefits		Net Benefits			B.C. Ratio
1. Great Central	1,814	8,445	-0	10,259	-0	30,070		?R	30,070	?R	19,811	?R	-0	2.93
2. Big Qualicum	4,556	11,339	-0	15,895	-0	31,752	1,920	?R	33,672	?R	17,777	?R	-0	2.12
3. Kennedy	1,426	5,408	-0	6,834	-0	18,674		?R	18,674	?R	11,840	?R	-0	2.73
4. Nitinat	5,580	9,535		15,115		23,532			23,532		8,417			1.56
5. Squamish	3,796	6,790	100	10,686		19,002			19,002		8,317			1.78
6. Long	1,528	3,479	-0	5,007	-0	12,683		?R	12,683	?R	7,676	?R	-0	2.53
7. Little Qualicum	4,818	6,900	-0	11,718	-0	18,944			18,944		7,226		-0	1.62
8. Kemano	15,369	13,181	-0	28,550	-0	35,548			35,548		6,998		-0	1.25
9. Henderson	1,231	3,006	-0	4,237	-0	10,604		?R	10,604	?R	6,367	?R	-0	2.50
10. Vedder-Chilliwack	5,343	7,035		12,378		18,735			18,735		6,357			1.51
11. Puntledge	9,697	3,349	50	13,096		11,082	6,841	+R	17,923	+R	4,827	+R		1.37
12. Hobiton	1,131	2,108	-0	3,319	-0	7,896		?R	7,896	?R	4,577	?R	-0	2.38
13. Inches	2,028	3,250		5,278		8,743	634		9,377		4,099			1.78
14. Tlupana-Canuma	4,105	5,750	905	10,760		14,306			14,306		3,546			1.33
15. Ankwil	10,130	5,035		15,165		18,175		?R	18,175	?R	3,010	?R		1.20
16. Deadman	2,949	559		3,508		1,790	3,070	+R	4,860	+R	1,352	+R		1.39
17. Kakweikan	1,334	1,462	-0	2,796	-0	3,918	4		3,922		1,126		-0	1.40
18. Embley	489	630		1,119		1,685	2		1,687		560			1.41
19. Cowichan	2,520	1,725		4,253		4,736			4,736		483			1.11
20. Blaney	1,510	1,106	+0	2,616	+0	2,885			2,885		269	+0		1.10
21. Burkenhead	2,432	311		2,743		1,104	1,830		2,934		191			1.07
22. San Juan	2,612	437		3,049		1,338	1,666		3,004		-45			0.99
23. Kitimat	15,339	4,423	-0	19,762	-0	15,356	3,998	+R	19,354	+R	-408	+R	-0	0.98
24. Wolf Lake	3,610	1,225	-0	4,835	-0	3,302	194		3,496		-1,339		-0	0.72
25. Nechako	5,671	493		6,164		1,053	1,933		3,706		-2,378			0.61
26. Mathers/Pallant	6,093	2,232		9,125		6,530			6,530		-2,595			0.72
27. Kalum	11,465	2,483		13,948		9,002	1,322	+R	10,324	+R	-3,624	+R		0.74
28. Babine	11,115	2,311		13,426		8,528		+R	8,528	+R	-4,898	+R		0.64

Project	Regional Development Account Ranking	Native People Account Ranking	Employment Account Ranking	Environmental Account Ranking	Rank Class
1. Great Central			Medium		1
2. Big Qualicum	Low/Medium		Medium		1
3. Kennedy			Low		1
4. Nitinat	High		Medium		1
5. Squamish		Low/Medium	Insignificant		1
6. Long					1
7. Little Qualicum	Low/Medium		Medium		1
8. Kemano	High	High	High		1
9. Henderson			Low		1
10. Vedder-Chilliwack			Medium		1
11. Puntledge		Low	Medium	High	1
12. Hobiton			Low		1
13. Inches		Medium/Low	Insignificant		1
14. Tlupana-Canuma	Low	Low	Low		1
15. Ankwil		Medium	High		1
16. Deadman		Medium	Low	Medium	1
17. Kakweikan	Medium	Low	Insignificant		1
18. Embley	Low	Low	Insignificant		2
19. Cowichan		High	Insignificant		2
20. Blaney		Medium/Low	Insignificant		2
21. Birkenhead		Medium	Insignificant	Medium	2
22. San Juan		Low	Insignificant	Medium	2
23. Kitimat	High	Medium/High	High	Medium	2
24. Wolf Lake			Insignificant	Medium	3
25. Nechako			Medium	Low	3
26. Mathers/Palliant		Medium	Medium		3
27. Kalum		Medium/High	High	Medium	3
28. Babine			Medium	Low	3

Notes

1 See Text

2 -O = unquantified opportunity cost
+O = unquantified opportunity benefit

3 -R = unquantified recreation disbenefit
+R = unquantified recreation benefit
?R = uncertain recreation benefit or disbenefit

TABLE 2 cont'd.

B. PROJECTS FOR WHICH PARTIAL ECONOMIC ANALYSIS HAS BEEN UNDERTAKEN.

Project	Capital and Operating Costs	Associated Costs2	Resource Interactions	Total Costs	Commercial and Indian Food Fish Benefits	Recreational Benefits3	Total Benefits	Net Benefits	B.C. Ratio
29. Tachie	10,844	20,429		31,273	75,448		75,448	44,175	2.41
30. Vedder-Chilliwack	27,014	17,978		44,992	52,236	20,713	72,949	27,957	1.62
31. Harrison	6,246	14,746		20,992	41,828		41,828	20,836	1.99
32. Nimpkish	8,119	13,097		21,216	35,148		35,148	13,932	1.66
33. Horsefly	7,710	7,537		15,247	28,508		28,508	13,261	1.87
34. Nimpkish	930	4,753		5,683	17,305		17,305	11,622	3.05
35. Stave/Squakum	5,815	9,920		15,735	26,350		26,350	10,615	1.67
36. Glendale	9,677	11,935		21,612	32,034		32,034	10,422	1.48
37. Vedder-Chilliwack	6,171	8,132		14,303	23,038		23,038	8,735	1.61
38. Harrison	3,020	7,035		10,055	18,735		18,735	8,680	1.86
39. Ahnuhati	4,811	7,483		12,294	20,082		20,082	7,788	1.63
40. Lowe Lake	729	2,750		3,478	10,839		10,839	7,361	3.12
41. Nadina	8,715	5,828		14,543	20,568		20,568	6,025	1.41
42. Harrison	14,761	4,940		19,701	18,756	5,847	24,603	5,847	1.25
43. McKinley	3,886	3,446		7,332	13,118		13,118	5,706	1.79
44. Kitimat	3,706	5,876		9,582	15,041		15,041	5,459	1.57
45. Bella Coola	4,221	4,946		9,167	12,567		12,567	3,400	1.37
46. Pitt	2,324	1,554		3,878	5,860		5,860	1,982	1.51
47. Toquart	3,116	3,380		6,496	8,363		8,363	1,867	1.29
48. Ain/Naden	817	743		1,560	2,932		2,932	1,372	1.88
49. Berriere	3,408	1,797		5,205	6,575		6,575	1,370	1.26
50. Deserted	4,661	3,424		8,085	9,420		9,420	1,335	1.17
51. Undesignated	710	707		1,417	2,665		2,665	1,248	1.88
52. Green Inlet	3,368	2,714		6,082	6,817		6,817	735	1.12
53. Ain	4,880	3,032		7,912	8,573		8,573	661	1.08
54. Kainet	3,758	2,842		6,600	7,241		7,241	641	1.10
55. Nicomen Slough	740	236		984	798	758	1,556	572	1.58
56. Kakweikan	7,969	5,089		13,058	13,617		13,617	559	1.04
57. Cowichan	2,528	1,725		4,253	4,736		4,736	483	1.11
58. Undesignated	604	344		948	1,327		1,327	379	1.40
59. Khutzeymateem	1,584	857		2,441	2,534		2,534	93	1.04
60. Kwatna	3,718	2,466		6,184	6,232		6,232	48	1.01

Project	Capital and Operating Costs	Associated Costs2	Resource Interactions	Total Costs	Commercial and Indian Food Fish Benefits	Recreational Benefits3	Total Benefits	Net Benefits	B.C. Ratio
61. Khutzemateen	3,190	1,676		4,866	4,844		4,844	-22	1.00
62. Upper Adams	2,641	962		3,603	3,541		3,541	-62	0.98
63. Birkenhead	1,939	404		2,343	1,360	806	2,166	-177	0.92
64. Nicola	3,825	775		4,600	2,669	1,644	4,313	-287	0.94
65. Toon	2,037	857		2,894	2,534		2,534	-360	0.88
66. Moricetown Falls	369			369					
67. Chuckwalla	7,590	3,043		10,633	10,122		10,122	-511	0.95
68. Coquitlam	2,298	1,107		3,405	2,887		2,887	-518	0.85
69. Bella Coola	14,244	5,518		19,762	19,203		19,203	-560	0.97
70. Bessette	2,452	323		2,775	1,086	1,030	2,116	-659	0.76
71. Little Qualicum	882	33		915	57	38	95	-820	0.10
72. Toba-Jervis	2,814	1,027		3,841	2,982		2,982	-859	0.78
73. Sarita	16,382	8,783		25,165	24,293		24,293	-872	0.97
74. Toon	3,190	1,198		4,388	3,453		3,453	-935	0.79
75. Wannock	3,890	1,948		5,838	4,839		4,839	-999	0.83
76. Kwatna	6,494	2,253		8,748	7,582		7,582	-1,166	0.87
77. Kakweikan	3,382	780		4,162	2,971		2,971	-1,191	0.71
78. Chilko-Chilcotin	2,794	530		3,324	1,296	652	1,948	-1,376	0.59
79. Kemano	4,905	1,565		6,470	4,343		4,343	-2,127	0.67
80. Yakoun	8,371	2,344		10,715	8,407		8,407	-2,308	0.78
81. Babine	6,277	1,996		8,273	5,885		5,885	-2,388	0.71
82. Wannock	4,732	657		5,389	2,509		2,509	-2,880	0.47
83. Tete Jaune	6,717	900		7,617	3,397	1,059	4,456	-3,161	0.58
84. Copper	6,488	1,274		7,762	4,598		4,598	-3,164	0.59
85. Coquitlam	9,770	1,263		11,033	4,031	3,818	7,849	-3,184	0.71
86. Eagle	6,525	764		7,289	2,855	890	3,745	-3,544	0.51
87. Morice	12,393	4,401		16,794	12,599		12,599	-4,195	0.75
88. Lowe Lake	6,502	929		7,431	3,192		3,192	-4,239	0.43
89. Cottonwood	6,695	603		7,298	2,212	689	2,901	-4,397	0.40
90. Squamish	10,810	1,430		12,240	5,178	2,567	7,745	-4,495	0.63

Project	Capital and Operating Costs	Associated Costs2	Resource Interactions	Total Costs	Commercial and Indian Food Fish Benefits	Recreational Benefits3	Total Benefits	Net Benefits	B.C. Ratio
91. Stuart	6,968	584		7,552	2,136	666	2,802	-4,750	0.37
92. Quinimass	8,138	1,714		9,852	5,068		5,068	-4,784	0.51
93. Deana	5,894	561		6,455	1,647		1,647	-4,808	0.26
94. Kwatna	9,276	2,336		11,612	6,494		6,494	-5,118	0.56
95. Kitimat	10,352	2,768		13,120	7,680		7,680	-5,440	0.59
96. Cranberry	14,133	3,206		17,339	11,849		11,849	-5,490	0.68
97. Quesnel	10,045	1,182		11,227	4,328	1,349	5,677	-5,550	0.51
98. Yakoun	7,793	1,076		8,869	3,110		3,110	-5,759	0.35
99. McGregor	9,890	1,092		10,982	3,978	1,236	5,214	-5,768	0.47
100. Kispiox	8,613	1,408		10,021	4,124		4,124	-5,897	0.41
101. Nitimat	11,973	2,283		14,256	7,395	844	8,239	-6,017	0.58
102. Quaal	10,533	2,381		12,914	6,643		6,643	-6,271	0.51
103. Atnarko	13,730	3,651		17,381	10,018		10,018	-7,363	0.58

TABLE 3

EXPORT MARKETS FOR CANADIAN SALMON
ACCORDING TO PRODUCT TYPE 1966-74

Product Type	Region	Percent of Total Exports Of Product Type (%)
CANNED	United Kingdom	52
	United States	11
	Australia-New Zealand	11
	Western Europe	14
	Others	12
	TOTAL	100
FRESH/FROZEN	United States	33
	France	22
	Sweden	9
	United Kingdom	9
	Japan	9
	Other Western Europe	12
	Others	6
	TOTAL	100

4. FEDERAL/PROVINCIAL RELATIONS IN THE SALMONID ENHANCEMENT PROGRAM

1. JURISDICTION

Under the British North America Act, Canada has exclusive jurisdiction over fishery resources. The Fisheries Act and regulations enacted under it express the formal powers of the Federal Government to manage and protect fisheries including anadromous species like salmonids. In practice, the interests of the Federal/Provincial government are linked by the limited delegation to B.C. of administrative responsibility for steelhead and trout recreational fisheries. In addition, B.C. has domain over property and civil rights under the BNA act; its formal responsibilities apply to fish once the fish are caught and become property. The B.C. Fisheries Act and regulations detail the capability of B.C. to license fishermen, fish buyers and fish processors. Inspection is carried out by both levels of government. B.C. inspects processing plants under its own legislation; the Federal Fisheries and Marine Service inspects fish products, plants and vessels under authority of the Fish Inspection Act and other federal legislation. Each uses the authority of the Federal Fisheries Act for management and enforcement.

Other provincial resource interests are also affected by Federal Fisheries policy. Regulations covering practices associated with such activities as road construction, watershed logging, mineral exploitation, and municipal and industrial waste disposal reflect the legislative authority of the Fisheries Act to protect fish and fish streams.

2. CONSULTATION AND PLANNING TO DATE

The Minister of Fisheries and the Environment has held a series of consultations with members of the Government of British Columbia. As a result of initial consultations, a Memorandum of Understanding was exchanged in December, 1975. This Memorandum of Understanding outlines in broad terms the co-operative nature of the salmonid enhancement program (S.E.P.). Staff of both the Federal Fisheries and Marine Service, Pacific Region, and the Provincial Ministry of Recreation and Conservation have interpreted this understanding broadly and constructively.

The S.E.P. has been discussed at every Federal-Provincial B.C. Fisheries Committee meeting since the idea was first put forth in 1974. Provincial fisheries officials are very supportive of this program and they have over the past two years been working to gain support for this program from other Provincial departments. At the most recent FPBCF Meeting, February 23, 1977, the Province indicated that they were confident of strong Provincial support for the S.E.P. This has been brought about because of a better understanding and a growing recognition by Provincial Ministers and officials of the importance of such a program to the Province of British Columbia and Canada generally.

Provincial officials recognize that the program required further review and approval by the Federal government and indicated that they would seek a similar type of approval at the Provincial level at the earliest possible date subsequent to Federal approval of the program. The spirit of these discussions was enthusiastic and optimistic.

Technical Planning Groups with members from each department have proposed projects which reflect the interests of both. For example, steelhead have received particular attention in facilities planning and, where stock identification forms a critical part of management decisions on harvest regulations, or where increased production is required to offset increased simultaneous exploitation with that of enhanced stocks of commercial species, current enhancement plans reflect these needs.

Other proposals are of equal interest to Federal and Provincial governments. Both governments have been in the business of hatching and rearing fish for a long time. The S.E.P. offers the opportunity of making major scientific advances through "a learn by doing" output of knowledge in a greatly expanded program encompassing a range of projects, from small-scale natural rehabilitation methods on small streams to large scale capital intensive projects.

3. IMPLICATIONS OF THE SALMONID ENHANCEMENT PROGRAM FOR THE PROVINCE

i) Fisheries Management

Although Canada has jurisdiction over Fisheries, benefits from the use of Pacific salmonids are enjoyed principally by British Columbians and management of fisheries for maximum net benefits is clearly in B.C.'s interest. In order to realize the full potential of the S.E.P. it could be necessary to discipline capital inputs and to recover government's investment costs. Recovery of costs arising from foregone opportunities could be achieved by the Province through increased processor license fees, taxes, or some other mechanism which should be co-ordinated with those of the Federal Government.

B.C. has a direct interest in commercial fisheries management policy beyond impacts on the processing industry. Escapements of steelhead and chinook and coho salmon affect the extent of the freshwater salmonid recreational fishery. The S.E.P. offers the opportunity of restoring declining runs, and re-opening streams long closed to anglers because of low escapements. On the other hand, the program poses the threat of increased exploitation of recreational fish stocks when these are mixed with enhanced stocks of commercial species. The prime concern of both the Federal and Provincial governments will be to see that net benefits are realized and risks and costs minimized.

ii) **Fisheries Research**

The S.E.P. will generate substantial new knowledge in fisheries management as well as fish production, especially in the early years of the program. Much of this knowledge will be of direct interest to the Province, for example: small stream enhancement techniques involving little capital investment and, experimental production of sea-run cutthroat trout. Much of what will be learned about the production of commercial species will be applicable to rainbow trout, the most widespread of non-tidal recreational species in B.C. A major problem which the S.E.P. will help resolve is the large scale interception of steelhead trout in the commercial fishery since stock identification programs should result in more precise data for stock management and allow more escapement of steelhead to the fresh water recreational fishery.

iii) **Other Resource Management**

Enhancement of salmonids in some streams may further constrain Provincial exploitation of other natural resources beyond what is now necessary in order to protect natural stocks. In those cases where additional reserves on forest resources, more restrictive zoning, tighter mineral extraction guidelines or waste disposal regulations are required as the result of an enhancement project, the costs to B.C. will be direct and measurable in terms of stumpage, royalties, assessments and dividends foregone. All or part of these additional costs could form part of the Province's contribution to the program.

A Federal-Provincial Economics Working Group has been addressing methodological problems in areas such as recreational fishing evaluation and the evaluation of resource interactions.

Shared fisheries management, research and habitat protection concerns have bound the agencies of both governments closely together over the years, but never to the degree or on the scale reached in the planning stages of the S.E.P.

4. SCOPE FOR CO-OPERATIVE AGREEMENT

Planning, research and evaluation have so far been carried out co-operatively in the S.E.P. between the two governments and could continue in the same vein. As the program moves into the implementation phase these elements will be combined with feasibility, construction, operation, and assessment of results. There appear to be no compelling 'a priori' reasons for excluding any of these additional elements from the scope of a co-operative agreement.

Funding for the S.E.P. has come almost entirely from the Federal government. The Province has contributed modest sums directly and has also committed substantial manpower resources. The bulk of the S.E.P. financing will undoubtedly continue to be carried by the Federal Government.

5. PUBLIC PARTICIPATION IN THE SALMONID ENHANCEMENT PROGRAM

INTRODUCTION

The Fisheries and Marine Service of the Department of Fisheries and the Environment conducted an intensive public information-education involvement process in the Pacific Region during the 1976/77 fiscal year, with the advice and assistance of a consulting specialist. The purpose of this exercise was to develop and test ways and means of fostering public participation in the planning and future implementation of salmonid enhancement. As a result of these studies, a plan for achieving a high degree of public participation has been developed and there is widespread public anticipation that there will be opportunity to participate in an effective program in place for the 1977/78 fiscal year.

OBJECTIVES

The following objectives are based on the need to increase the community's understanding of the problems of salmonid survival, to promote awareness of solutions to these problems, and to strengthen the role of the public in helping to conserve this fisheries resource.

1. To promote public awareness of concerns for and commitment to the protection of stream systems and estuaries as essential elements of a long-term program of salmonid enhancement.

2. To provide the concerned public with factual information on the goals, strategies, methods, implementation plans, costs, benefits and administrative organization of the salmonid enhancement program.

3. To develop a communication system to ensure that plans for salmonid enhancement reflect the reasonable views and desires of those citizen groups who will be affected by the program.

4. To provide opportunities for the public to participate in salmonid enhancement projects.

TIMING

A public participation program will be designed to encourage a high degree of interaction between the technical program planners and the interested, involved public. Public involvement activities in any given area will be closely coordinated with implementation of technical programs.

THE PUBLIC

1. Users of the resource, classified as "clients"; i.e., fish processors, commercial fishermen, recreational fishermen, Indian subsistence fishermen.

2. The public-at-large who own the resource. Provision will be made to assure that both active and passive participation needs are served.

3. School children from primary through senior secondary school levels.

4. Native Indians will receive special attention so that current two-way communication problems can be resolved and their involvement can be facilitated.

RELATIONSHIP TO OTHER PLANS

1. Public participation activities will be linked closely with community involvement projects. Community involvement in salmonid enhancement is seen as a process in which voluntary participation by individuals and organized groups in restoration and protection of salmonid habitats to improve salmonid production is co-ordinated with employment of largely unskilled labour in employment-intensive, low-capital salmonid enhancement activities of primary interest within a community.

2. This program will also be coordinated with more general fisheries information services.

ON-GOING EVALUATION

1. Evaluation will be continuous through the life of the salmonid enhancement program and, of course, will relate to success in achieving program objectives. Measurements of success or failure will be obtained in a number of ways; for example: public enquiries in a number of representative communities will give opportunity for individuals and groups to make direct comment on performance; numbers and frequency of individual and group involvement in educational activities, small stream projects, and protection and restoration of habitats will measure performance in a general way; the number of additional fish produced as a result of public involvement - direct and indirect - will perhaps be the ultimate measure.

2. It is projected that the strategies of the public participation program will need to be flexible and dynamic and shaped to a significant degree by the participating public.

3. The success or failure of linking community aspirations and the goal of increased supply of salmonids will be assessed on a community-by-community basis.

OTHER PERTINENT FACTORS

1. Two levels of advisory input will be sought:

   a) At the British Columbia regional level, through a Task Group which will act as a forum for: review of policy proposals; consideration of strategies and plans for achieving approved policy; and, for suggesting new thrusts and strategies to management of the salmonid enhancement program. This B.C. Task Group would be comprised, for example, of representatives of the commercial and recreational fishing industries, Chambers of Commerce, Indian groups, consumer groups, forest industry, public-at-large and community groups.

   b) At the community level, through local Task Groups which will review and advise on technical enhancement proposals from the point of view of local impacts.

2. A very substantial effort will be made to respond to initiatives taken by service groups and particularly by schools which aim at youth involvement in field projects directed at increasing salmonid supply by improving and protecting fish habitats and/or operating small enhancement facilities.

3. It is important that 1977/78, as the first year of implementation of an approved salmonid enhancement program, be treated as a "pilot" year in which a wide range of approaches continue to be tested by those involved while, concurrently, a sound administrative base is actively developed.

4. This community involvement approach has been tested informally already in a sub-region and has been strongly recommended as a model by the public participants and technical staff involved.