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SALMON RESOURCE DEVELOPMENT IN NEWFOUNDLAND & LABRADOR

FISHERIES RESEARCH BRANCH
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ST. JOHN'S, NEWFOUNDLAND

A document prepared by the CORE working group on Nfld. salmon enhancement

Canada

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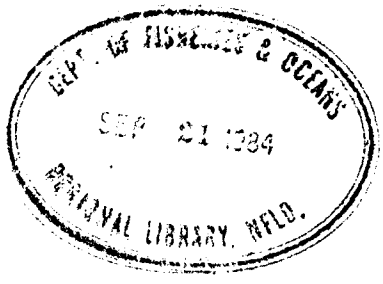

(Compiled by J. D. Pratt)

Fisheries Research Branch

Department of Fisheries and Oceans

St. John's, Newfoundland

nlc from Jerry Pratt

A Document Prepared By

The CORE Working Group on Newfoundland Salmon Enhancement

July, 1984

Preface

During mid-December 1983 a discussion document entitled "Salmon Enhancement in Newfoundland and Labrador" was jointly released by the Gulf and Newfoundland Regions of the Department of Fisheries and Oceans. The document was prepared through the efforts of several federal and provincial departments. The document outlined for public review the then current status of work towards developing a comprehensive plan to significantly improve the Atlantic salmon resource in Newfoundland and Labrador, thereby effecting improvements in the social and economic base of the province. Since then, DFO representatives have participated in six public meetings and received a total of 14 briefs from various organizations wishing to contribute in one way or another to the final document. Comments received either at these meetings or from written briefs have since been critically evaluated and integrated into this document on Salmon Resource Development in Newfoundland and Labrador.

This document is now being made available to those organizations involved in its preparation so that appropriate consideration may be given to development of implementation plans.

SALMON RESOURCE DEVELOPMENT IN NEWFOUNDLAND AND LABRADOR

(SUMMARY)

(Compiled by J. D. Pratt)

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OVERVIEW

In the late 1970's it was recognized by many that the Province of Newfoundland and Labrador had the potential to produce far more Atlantic salmon that it currently produces and that the social and economic well-being of the people of the province could be significantly improved by development of that potential. Thus, from 1980 to 1982 eight provincial and federal agencies met to consider the desirability and practicality of launching such an Atlantic salmon development program.

Upon completion of the plan changes in DFO regional responsibilities led to the establishment of the Gulf Region and this new Region assumed responsibility for the river systems flowing into the Gulf of St. Lawrence. The overall concept of the plan and specific projects in the Gulf Region have been reviewed by that Region. Sites of projects in both the Newfoundland and Gulf Regions are identified in Fig. 1.

The ten-year program proposal ultimately developed called primarily for the implementation of a cost-effective scheme, involving low or intermediate level technology, which would almost double the production of salmon in the province. Public/community involvement would be an underlying principle of much of the enhancement activity. The main thrust of the plan would by its nature maintain the natural genetic diversity and life history patterns of the salmon stocks while at the same time expanding these stocks into previously unused habitat in the province.

The plan would be modular in concept and include a total of 21 projects using one or more development strategies and involving nearly 50 river systems throughout Newfoundland and Labrador. Implementation of colonization, public enhancement, and sea farming projects, along with completion of pond ranching pilot projects would be emphasized during the first two years of the program. The first full scale pond ranching projects would then come on stream in the third year, while refinements to the DFO component of a hatchery project at Bay d'Espoir proceeded on the south coast rivers. In the fourth year hatchery stocking operations would be initiated as would research and feasibility investigations into Pacific introductions.

By the end of the ten-year program, salmon landings should expand by nearly 1500 metric tonnes within commercial fisheries or aquaculture facilities and recreational fisheries should increase by another 50,000 adult salmon. Fifty-five million dollars would be invested over a decade with the direct employment of an estimated 250 full-time or seasonal employees each year during the start-up phase plus the creation of an additional 200 long-term jobs during the operations phase of the program. The present ten-year program could be expanded so as to contain additional projects to allow even greater increases in salmon production and benefits than outlined in this plan.

A key spin-off benefit of this plan is the coupling of increased catches in Newfoundland's commercial fisheries with a reduction in the **proportion** of mainland origin salmon being taken. This will enable managers to actually increase Newfoundland's overall catch of salmon while decreasing the **number** of mainland salmon taken. Without enhancement, reduction of interception would mean imposition of economic hardships to many fishermen.

SUMMARY

THE ATLANTIC SALMON DEVELOPMENT PLAN

NEWFOUNDLAND-LABRADOR

The Atlantic salmon fisheries in eastern Canada could be returned to the higher production levels of fifty years ago. Special Planning Groups have now assembled a plan of salmon development for Newfoundland-Labrador as one component of an eventual overall program for Atlantic Canada. The extensive development plan now described would create new economic and social benefits, especially for the fishery users and residents of Newfoundland-Labrador.

The Atlantic salmon

The sea-run salmon resource of the province is found in over 160 scheduled rivers plus several hundred unscheduled rivers which contain an assortment of large and small streams. Upon hatching in the rivers as fry the young salmon spend from 2 to 7 years in fresh water as parr and finally move to sea as smolts. They spend a further 1 to 3 years feeding in the Atlantic Ocean and return as adult salmon to their natal rivers to spawn as 1-sea-winter salmon (<2.7 kg) or as large salmon (>2.7 kg) multi-sea-winter. It is during their coastal feeding and spawning migration that they encounter the various fisheries.

The fisheries

Commercial, recreational and native people harvest the Atlantic salmon. The native peoples of Labrador harvest them under a system of special food permits and about 5300 other licenced commercial fishermen harvest approximately 2000 metric tonnes of salmon annually within the province's inshore coastal fishery, representing 90% of the total Canadian commercial harvest. It has been estimated that in the order of 200 metric tonnes of Newfoundland and Labrador origin salmon are annually harvested in the West Greenland fishery. More than 40,000 fish, or 30-40% of the total Canadian angling catch, are taken annually in the province by about 40,000 anglers.

Habitat deterioration

During the past century, habitat deterioration and overfishing have stressed the Atlantic salmon in Newfoundland. Pulp and paper and hydro power developments have taken their toll starting in the late 19th century. More recent industrial expansions impacting on the habitat of the salmon began in the 1960's and have included mechanization of the forest industry with increased forest harvesting, the establishment of an island-wide highway system, and a hydroelectric transmission line associated with new generation projects.

Shift in salmon management policy

Since the 1970's new aquatic habitat protection legislation, international negotiations toward reduction of the West Greenland harvest together with local

restrictive measures on angling and commercial fisheries affected gradual improvement in the Newfoundland stocks. More recently, national task forces and committees have examined the implications of management and harvest problems within eastern Canada and recommended broader coordinated approaches for salmon stocks throughout the five Atlantic provinces. Consequently, major shifts in management policy were announced for the 1980's; these included provincial fishery restrictions, the most important being to significantly reduce the interception by the Newfoundland commercial fishery of salmon from other provinces' rivers. In 1984, the restrictions included a mandatory licence buyback program for parts of Newfoundland's south coast, and significant delays in the opening of the fisheries in other areas.

Towards increased salmon production

The above shift in policy was recommended in combination with an economic development thrust which would include an extensive long-term development program designed to restore and improve fishery benefits. Techniques such as stream remedial operations, fishway construction, adult transfers, and swim-up fry stockings were already available for development of river enhancement strategies. Blasting and channelling have already been successful in removing barriers that formerly hampered salmon migrations in 25 streams and marked increases in salmon runs were demonstrated with fishway construction on another five important watersheds. In addition, combining fishway construction with stocking of the newly opened areas using adult transfers or fry plantings greatly accelerated establishment of 35,000 adults in two other major watersheds. Although there are no government salmon hatcheries in Newfoundland, several locations have received consideration as prospective sites and pen rearing pilot projects are showing promise for a future salmonid sea farming industry. It has been recognized that such combined approaches could double the Atlantic salmon production in the province and allow a return to the high fishery yields of the mid-1930's.

Special federal-provincial development planning groups were established in 1980 to design a ten-year program for the development of the salmon stocks of Newfoundland. The general technical, economic, and social rationale for the program was assembled and is now ready for consideration.

Development and interception reduction

Current management strategies are aimed at reducing the interceptions of Maritime-Quebec salmon taken in the Newfoundland commercial salmon fishery. This will improve the salmon supply to Maritime and Quebec fisheries as well as spwning escapements. However, these result in serious harvest reductions along the southeast and northeast coasts of Newfoundland. The reductions in catches could be further influenced by an appreciable loss of harvestable Newfoundland origin salmon which will escape the fisheries into the rivers (including some rivers where they will not be taken in the angling fishery).

Under this revised harvesting regime, it is impractical to modify the existing inshore fishery so as to effectively absorb the harvestable surplus of Newfoundland origin salmon without creating serious economic and social consequences to established inshore fishermen. Application of enhancement

in Newfoundland rivers would compensate for these restrictions by increasing catches of Newfoundland origin salmon; enhancement could also enable the creation of new river mouth and terminal fisheries which would discretely crop those salmon surplus to spawning needs which are released from the traditonal inshore fisheries. The proposed management scenario involving 10 major river enhancement projects could remedy most of the major expected negative impacts on the inshore fishery.

The economy: The major beneficiary

The key beneficiaries of a development program will be the commercial, recreational, and native fishermen. Eventually, an additional 1500 metric tonnes would be available annually for commercial salmon interests (Table 1), which is equivalent to an increase in landed value of over $6 million (1981 dollars) with a retail value almost twice that figure. Preliminary marketing analysis indicates that domestic and export demands for increased commercial salmon production will remain elastic in the forseeable future although the marketplace may prove subject to periodic price depressions.

The extensive enhancement program aimed at both the user and public alike, would result in added social and economic benefits for residents of the province. Extra jobs would be created during 5 years of construction in the program (Table 2). Technological advances from the research and development phase of the program would result in new and improved approaches to fisheries management and enhancement.

Boosting the recreational potential

The recreational fishery would have an increased supply of large salmon, thereby improving quality, success, and interest in angling throughout the province. A current increase in demand for salmon recreational fishing has raised overall catch totals but with declines in harvest quality in terms of catch rate and the frequency of large salmon. The new fishery regimes involving both interception reduction and enhancement thrusts within the existing and newly opened watershed fishing areas would greatly increase the recreational harvest and fishing success rates. It is expected that the planned enhancement will contribute an additional 50,000 fish to the recreational fishery, or roughly a doubling of the existing catch.

The role of native peoples

Native involvement in salmonid enhancement could become important especially, in remote areas where opportunities for improved income and employment are low. Dialogue and cooperation between government and native groups concerning the aboriginal rights issue could also be expected to improve as a result of participation in such joint ventures. The Labrador native Naskaupi and Inuit people of Labrador have already expressed interest in developments of new freshwater fisheries.

Public involvement

Salmon enhancement presents an excellent opportunity for the conservation-minded public to become involved in the actual planning and conduct of its own projects and enhancement thrusts will draw heavily on volunteers and community groups. This approach will greatly assist DFO in the design and operation of projects as well as educate residents regarding their role in environmental preservation, conservation and protection, and resource development.

Involvement of communities in long-term enhancement ventures would improve fishing, generate new income, as well as provide new employment, manpower training, and regional development. Conservation associations, rod and gun clubs, and other volunteer organizations will be encouraged to get involved in the planning of small stream projects designed to inform and educate about resource and government related programs. Of course such activities will also provide major contributions to restoring, maintaining, or improving salmonid habitat and the fish populations.

Education

As part of the public education thrust students in school science courses would be exposed to a special enriched curriculum focused on the salmon resource. The object would be to instill an early awareness to the role of salmon in the ecosystem and the mutual dependence of man and the resource and to use this as a model which would apply to the understanding of important marine species as well.

Federal-Provincial cooperation

Commitment of the federal government to enhancement of salmon could have significant consequences for alternative usage of provincially administered resources of water, forestry, and minerals. Hence, there is a need for federal-provincial cooperation and negotiation throughout the program.

A Newfoundland federal-provincial memorandum of understanding towards planning an extensive enhancement proposal would be forwarded for consideration by the ministers responsible. More formalized arrangements covering cooperation between the two governments will be developed when it is decided to implement the plan.

Three federal and six provincial agencies have jointly helped with the design of the salmon enhancement program through representation on the CORE and Technical Planning Groups. Canada Employment and Immigration (CEIC) is actively exploring new employment training approaches through financial and other support of a community fisheries enhancement demonstration project in St. Mary's Bay, Avalon Peninsula. The Department of Regional and Industrial Expansion (DRIE) has advised on regional development impacts of the proposed program with the Department of Indian and Northern Affairs (DINA) consulting on directions required for native people.

The provincial agencies have reviewed enhancement matters pertaining to industrial water use, environment, rural development, fisheries, tourism, education, and intergovernmental affairs. For example, the Provincial Department of Fisheries and Memorial University of Newfoundland have considered with DFO the development of cooperative arrangements for an emerging aquaculture industry. The Department or Rural, Agricultural and Northern Development has supported the planning of public enhancement projects within communities through 49 local development associations. Many of these associations have already submitted enhancement proposals which the provincial Department is willing to support. Salmon enhancement information is being reviewed by the two departments responsible for use in secondary and school science curricula and for park interpretation programs.

THE ENHANCEMENT PLAN AND ITS STRATEGIES

The salmon enhancement program would be implemented over a 10-year period. The approach would be one of incorporating a mix of low, intermediate, and high technology strategies which have been assessed as sound. These would be gradually blended with improved approaches demonstrating feasibility through research and piloting.

Planning groups determined biological and engineering feasibilities through modelling exercises on watershed production potential, fishery management, and harvesting regimes. Strategy options were next developed along with basic cost production flows through to post-evaluation stages. Alternatives were next subjected to a general socio-economic framework of criteria relating mainly to national income generation but also to employment, regional development, and native/environment well-being. Benefit:cost analysis was conducted on the series of most appropriate enhancement options.

Five major enhancement strategies were developed for the program.

Colonization

"Colonization" involves the provision of fish passage at total salmon migration obstructions while 5-7 year stockings proceed on the newly opened areas to ensure rapid buildup to maximum production. This strategy will initially be the major thrust of the new enhancement program. The plan envisages that three colonization projects for salmon could begin on the Terra Nova and Humber rivers in Newfoundland, plus the Canairiktok River in Labrador. Test stocking would continue on one of the tributaries of the headwaters of the Exploits River, stocking of the remaining Exploits tributaries and construction of fishways would be completed during 1985-89. Additional projects would be more fully described for implementation during the second year of implementation and would be dependent on increased budget allocations; these would require complete fish passage and stocking investigations during the first year.

Annual production potential of Atlantic salmon colonization projects is estimated to be up to 129,000 adults providing an annual harvest of 94,000 adults or 203 tonnes to commercial fishermen and 9,500 fish to sportsmen. The

mix of projects has acceptable benefit to cost ratios (Table 3). New conservation and protection costs relating to management and harvesting of enhanced stocks were received just prior to completion of this document and will be incorporated in future revised socio-economic evaluations and be included in new benefit-cost analyses.

Pond rearing

Promising experimental research suggests a second strategy, "pond rearing". This strategy refers to the continuous planting of swim-up fry into lakes or ponds to achieve increased salmon production. It is proposed that a pilot project be initiated during the first year at Black Brook, near Halls Bay. The facilities envisaged would also enable testing stocking of partially grown (fed) young salmon. As well, it would serve as a model for refining public involvement approaches to salmon enhancement training and education. Following these strategy refinements, five additional projects would be initiated between the second and fifth years and would involve development of 11 streams within western, northern, and central areas of the island.

For the projects identified, the estimated production is 320,800 adult salmon which could provide an annual yield of 513 tonnes (216,000 adults) to the province's commercial fishermen and 33,000 fish for the sports angler. Benefit to cost ratios are more favourable than for the colonization strategy due to higher harvesting rates, reduced start-up periods, and the lack of expensive fish passage facilities.

Fish culture

The third enhancement strategy proposed, which is designed for both the development of public fisheries and private sea farming ventures, is intensive fish culture; although present investigations suggest this is promising in some areas, further research is required to perfect this approach. During the first two years of the program the provincial government will consider participating in the construction of a modular type plant at Bay d'Espoir on Newfoundland's south coast which in the first phase would serve an emerging aquaculture industry as well as provide salmonids for research purposes. DFO would then consider a second phase in the third year to support public fisheries enhancement. Hatchery production at Bay d'Espoir appears promising because of its ground and surface water supply as well as an industrial waste heat source which can be used to accelerate early juvenile growth.

Adaptation of existing technology for Atlantic salmon farming to Newfoundland waters will require development of a flexible modular-type rearing facility. Hatchery production would initially produce over 140,000 adult salmon or almost 500 metric tonnes of landings in sea farms located in the Bay d'Espoir coastal area, plus another 120,000 salmon from annual stocking of six major rivers on the south coast and five on the Avalon Peninsula. It is anticipated that output at such a plant could be combined to include mitigative stocking resulting from the damaging effects of hydroelectric water diversion, production of smolts for commercial fish farming, and fry, fingerling and smolt production for enhancement or sea ranching activities along the south coast of Newfoundland. Provincial agencies are optimistic that a fish culture station

at Bay d'Espoir could eventually produce up to 200,000 one-year smolts for private fish farmers.

Provincial agencies are now confident that, with their experience, 200,000 one-year smolts could be produced at the hatchery. These could be used for the economic production of salmon with direct long-term employment generation in the adjacent coastal area. DFO interests in the multi-purpose hatchery would focus primarily on enhancement of public fisheries: initially 1.3 million fry would be planted to increase production in south coast rivers. Eventually 100,000 fall fingerlings and 50,000 one-year smolts would support intensive fisheries in metropolitan areas such as on the Avalon Peninsula.

Stock remedial activities

Within the fourth strategy of the enhancement program, regulatory controls for increased river spawning escapements would be combined with stream clearance, spawning or nursery habitat improvements, and stocking activities to restore or maintain runs to numerous small watersheds of the province. A public involvement thrust would include as key ingredients: education-training on enhancement through DFO community and technical advisors, grants or employment contracts; and most importantly, a demonstrated interest and commitment of the public to enhancement.

A total of seven public project proposals have been identified and submitted by various development associations and conservation groups as part of this aspect of the enhancement program. This mix of volunteer/community projects on the Newfoundland-Labrador streams will utilize low level investments to maintain or improve Atlantic salmon runs while at the same time, providing increased employment and regional development.

Pacific salmon introductions

A further possible strategy relates to the possibility of the eventual introduction of Pacific salmon species to the province. However, if we are to ensure stablility of existing stocks of salmonids, and the effectivenes of the approach, extensive research is advocated. Feasibility investigations could commence in 1985 and 1986 with the first pilot projects in 1987.

RECAP

A total of 21 projects have been identified using one or more enhancement strategies and involving nearly 50 river systems thoughout Newfoundland and Labrador (Figure 1). Implementation of colonization, public enhancement, and sea farming projects, along with completion of pond ranching pilot projects would be emphasized during the first two years of the program. The first full scale pond ranching projects would then come on stream in the 3rd year, while refinements to the DFO component of the Bay d'Espoir hatchery projects proceed on the south coast rivers. In the fourth year the south coast hatchery projects would be initiated as would the first research and feasibility investigations into Pacific salmon introductions.

An enhancement program would create greater economic stability and diversity, as well as social well-being for the provincial society through improved employment or investment and through environmental and resource preservation thrusts. By the end of the outlined ten year program, salmon landings should expand by nearly 1500 metric tons within commercial fisheries or aquaculture facilities and recreational fisheries should increase by another 50,000 adult salmon. Fifty-five million dollars would be invested over a decade with the direct employment of an estimated 250 full-time or seasonal employees each year during the start-up phase plus the creation of an additional 200 long-term jobs during the operations phase of the program. The present ten year program could be expanded so as to contain additional projects to allow even greater increases in salmon production and benefits than outlined in this plan (Tables 1-3).

PUBLIC INPUT AND CONSULTATIONS

Since its release in mid-December, 1983, the discussion document has been reviewed and commented upon by a variety of groups, organizations, and individuals throughout Newfoundland and Labrador. A total of 14 briefs have been forwarded to DFO and public meetings on enhancement and the contents of the document were held at selected central locations throughout the Province. Dates and locations were as follows:

Date (1984)	Location
February 27	Springdale
February 28	Gander
February 29	Grand Falls
March 1	Goose Bay
March 5	Clarenville
March 8	St. John's

Copies of the briefs received have been incorporated into the document. The major topics discussed at the public meetings have been summarized and are also included.

Throughout the briefs and public meetings several similar concerns were raised. These included:

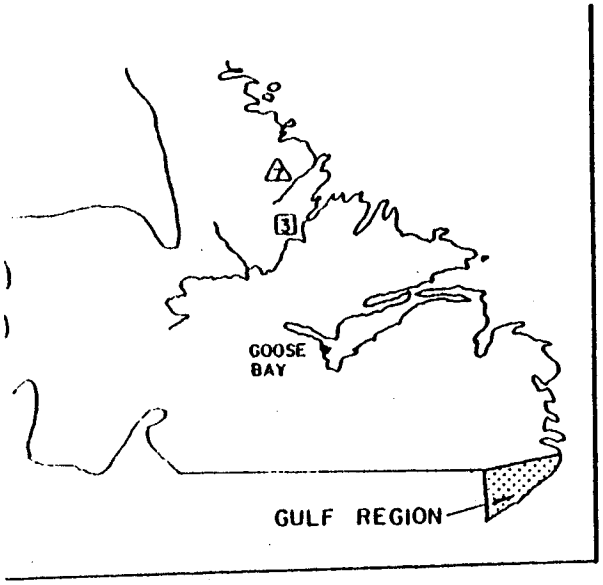
1. The lack of a financial committment by DFO for salmon enhancement. Although outside agencies were commended for their monetary committments it was felt that this may result in projects serving too many masters and not addressing the specific needs of enhancement.

2. The educational thrust as outlined in the document was felt to be too narrow. It was generally felt that such a component should be broadened to include all facets of society, with emphasis on preschool and primary school children.

3. The capacity of DFO staff to administer 21 projects on nearly 50 river systems was questioned. Many groups are aware that at present, the public involvement component of DFO is stretched to the limit and it is doubtful any new proposals can be supported unless new budgetary resources are obtained.

4. A need was identified for better information links between DFO and various groups interested in enhancement. Also, it was felt that more training workshops and seminars on enhancement should be available to interested groups.

5. Numerous enquiries were received on the content of the 1984 salmon management plan. These questions were turned over to local Resource Management Division staff who were present at each meeting.



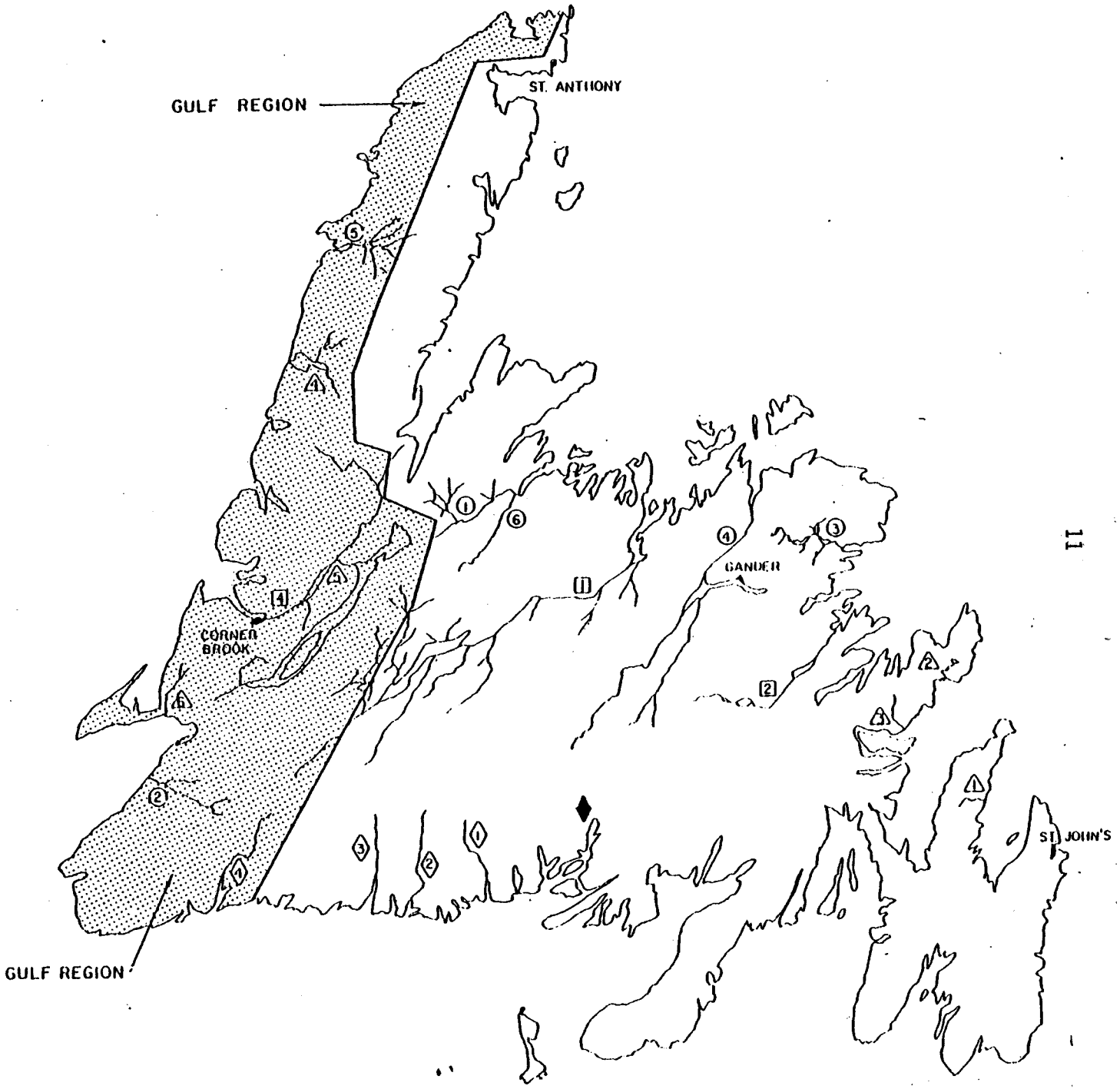


Figure 1. A total of 21 projects throughout Newfoundland and Labrador will almost double the province's. production of Atlantic salmon by the 1990's.

Table 1. Preliminary cost ($1984 x 1000) and person year (no.) flows for a mix of projects from Newfoundland/Labrador Atlantic Salmon Plan.

Project	1	2	3	4	5	6	7	8	9	10
Exploits River										
Person year equiv.	4.7	6.7	6.7	6.7	6.7	6.9	4.0	4.0	4.0	4.0
Capital (x $1000)	10.7	-	67.1	764.9	1,073.6	536.8	-	-	-	-
*O/M (x $1000)	118.8	120.2	120.2	167.1	136.6	140.3	140.3	140.3	141.5	74.4
Humber River										
Person year equiv.	1.7	1.4	1.4	1.6	1.1	1.8	0.9	0.9	0.9	0.7
Capital (x $1000)	26.8	1.3	1.3	-	603.9	-	-	-	-	-
O/M (x $1000)	16.1	47.0	47.0	47.0	40.3	60.4	21.5	21.5	21.5	21.5
Terra Nova River										
Person year equiv.	1.7	2.5	1.7	1.7	1.7	2.6	0.9	0.9	0.9	-
Capital (x $1000)	8.1	6.7	-	-	-	-	-	-	-	-
O/M (x $1000)	33.6	53.9	26.8	26.8	26.8	134.2	6.7	6.7	6.7	6.7
Canairiktok River										
Person year equiv.	5.4	5.4	3.4	5.5	3.0	2.9	0.6	0.6	1.3	1.3
Capital (x $1000)	103.7	-	793.0	20.1	-	-	1,006.5	1,274.9	-	-
O/M (x $1000)	36.6	36.6	92.6	75.2	64.4	60.0	48.3	68.3	39.0	39.0
Black Brook										
Person year equiv.	4.1	1.5	2.5	2.5	2.5	2.7	1.8	1.8	1.8	1.8
Capital (x $1000)	563.6	-	-	-	-	-	-	-	-	-
O/M (x $1000)	38.3	34.9	36.2	36.2	36.2	37.6	36.2	36.2	36.2	36.2

Table 1. (cont'd)

Project	1	2	3	4	5	6	7	8	9	10
Robinsons River										
Person year equiv.	-	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
Capital (x $1000)	-	603.9	-	-	-	-	-	-	-	-
O/M (x $1000)	-	26.8	26.8	26.8	26.8	26.8	26.8	26.8	26.8	26.8
Indian Bay Brook										
Person year equiv.	-	-	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
Capital (x $1000)	-	-	536.8	-	-	-	-	-	-	-
O/M (x $1000)	-	-	13.4	13.4	13.4	13.4	13.4	13.4	13.4	13.4
Gander										
Person year equiv.	-	1.0	0.4	2.6	2.1	2.1	2.1	2.1	3.2	2.8
Capital (x $1000)	-	-	1.3	671.0	-	-	-	-	-	-
O/M (x $1000)	-	4.0	6.7	34.9	41.6	42.9	42.9;	42.9	47.0	45.6
Torrent River										
Person year equiv.	-	-	0.7	1.3	1.4	3.0	5.8	5.8	6.0	6.0
Capital (x $1000)	-	-	4.0	671.0	-	-	-	-	-	-
O/M (x $1000)	-	-	13.4	24.4	81.9	49.7	55.0	55.0	55.0	55.0
South Brook										
Person year equiv.	-	-	-	-	2.4	2.4	2.4	2.4	2.4	2.4
Capital (x $1000)	-	-	-	-	603.9	-	-	-	-	-
O/M (x $1000)	-	-	-	-	26.8	26.8	26.8	26.8	26.8	26.8
Salmon Cove/Broad Cove										
Person year equiv.	0.8	2.8	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Capital (x $1000)	3.1	7.3	1.8	-	-	-	-	-	-	-
O/M (x $1000)	3.7	23.2	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5

Table 1. (cont'd)

Project	1	2	3	4	5	6	7	8	9	10
Salmon Cove/Port Union										
Person year equiv.	2.3	2.0	1.8	1.8	1.8	2.0	2.5	2.5	2.5	2.5
Capital (x $1000)	2.4	1.2	1.2	-	-	-	-	-	-	-
O/M (x $1000)	29.2	12.2	12.2	12.2	12.2	12.2	12.2	12.2	12.2	12.2
Hickman's Harbour (Feasibility - 1 year)										
Person year equiv.	1.6									
Capital (x $1000)	7.3									
O/M (x $1000)	9.2									
Brians Feeder										
Person year equiv.	4.5	6.5	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2
Capital (x $1000)	53.1	215.9	12.2	-	-	-	-	-	-	-
O/M (x $1000)	54.3	133.5	97.2	97.2	97.2	97.2	97.2	97.2	97.2	97.2
Fox Island River, Serpentine River and Romaines Brook										
Person year equiv.	4.3	5.7	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2
Capital (x $1000)	37.6	154.3	9.8	-	-	-	-	-	-	-
O/M (x $1000)	36.5	40.8	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2
Bay D'Espoir Sea Farming (Phase I - Provincial)										
Person year equiv.										
Capital (x $1000)	-	3,335.0	112.0	-	-	-	-	-	-	-
O/M (x $1000)	-	137.9	299.0	841.8	1,478.6	1,478.6	1,478.6	1,478.6	1,478.6	1,478.6

Table 1. (cont'd)

Project	1	2	3	4	5	6	7	8	9	10
Bay D'Espoir River Stocking (Phase II - DFO)										
Person year equiv.	-	-	1.0	1.0	2.5	3.0	3.0	3.0	3.0	9.0
Capital (x $1000)	61.0	30.5	103.1	1,830.0	732.0	30.5	18.3	18.3	30.5	73.2
O/M (x $1000)	-	-	-	144.6	214.0	221.4	221.4	221.4	221.4	439.2
DFO Project Direction/Administration (mandatory for implementation of above projects)										
Person year equiv.	13.0	15.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0
Capital (x $1000)	140.3	54.9	73.2	48.8	97.6	97.6	97.6	97.6	97.6	97.6
O/M (x $1000)	250.0	265.9	276.9	312.3	312.3	312.3	312.3	312.3	312.3	312.3

*Note O/M does not include salary costs. Average person year equivalent cost = $27,620.

Table 1a. Summary table outlining preliminary total annual production and harvest flows from an implemented Salmon Enhancement Program of seven projects in the western Newfoundland portion of the Gulf Region.

Strategy	Year												
	5	6	7	8	9	10	11	12	13-18	19	20-23	24	25
Colonization - Pond Ranching													
Total production (no.)			22,500	32,100	32,100	71,790	88,800	109,300	113,800	125,850	135,300	155,810	164,600
Commercial harvest (kg)			27,792	48,672	48,672	108,230	146,332	177,026	187,106	201,803	222,973	246,589	266,277
Recreational harvest (no.)			1,155	1,565	1,565	5,930	6,270	8,525	8,615	9,941	10,130	12,386	12,562
Public Projects													
Total production (no.)			4,302	6,146	6,146	6,146	6,146	6,146	6,146	6,146	6,146	6,146	6,146
Commercial harvest (kg)			9,926	9,926	9,926	9,926	9,926	9,926	9,926	9,926	9,926	9,926	9,926
Recreational harvest (no.)			485	526	526	526	526	526	526	526	526	526	526
Total													
Total production (no.)			26,802	38,246	38,246	77,936	94,946	115,446	119,946	131,996	141,446	161,956	170,746
Commercial harvest (kg)			32,524	58,598	58,598	118,156	156,258	186,952	197,032	211,729	232,899	256,515	276,203
Recreational harvest			1,640	2,091	2,091	6,456	6,796	9,051	9,141	10,467	10,656	12,912	13,088

Table 1b. Summary table outlining preliminary total annual production and harvest flows from an implemented Salmon Enhancement Program of 13 projects in the Newfoundland Region.

Strategy	Year												
	5	6	7	8	9	10	11	12	13-18	19	20-23	24	25
Colonization - Pond Ranching													
Total production (no.)	22,600	44,600	46,800	81,479	186,340	260,230	283,340	296,700	296,700	319,100	328,700	328,700	328,700
Commercial harvest (kg)	23,200	67,900	69,600	90,782	251,884	422,164	458,378	480,906	480,906	515,560	537,064	537,064	537,064
Recreational harvest (no.)	3,400	6,200	6,800	12,401	20,604	22,532	25,660	27,428	27,428	29,892	30,084	30,084	30,084
Intensive Fish Culture (Provincial)													
Sea Farming													
Total production (no.)	145,407	145,407	145,407	145,407	145,407	145,407	145,407	145,407	145,407	145,407	145,407	145,407	145,407
Commercial harvest (kg)	496,280	496,280	496,280	496,280	496,280	496,280	496,280	496,280	496,280	496,280	496,280	496,280	496,280
River Stocking													
Total production (no.)	18,000	36,000	51,000	51,000	51,000	58,000	121,000	121,000	121,000	121,000	121,000	121,000	121,000
Commercial harvest (kg)	29,330	58,661	83,103	83,103	83,103	94,509	197,167	197,167	197,167	197,167	197,167	197,167	197,167
Recreational harvest (no.)	1,975	3,950	5,596	5,596	5,596	6,364	13,278	13,278	13,278	13,278	13,278	13,278	13,278
Public projects													
Total production (no.)			1,500	1,500	1,500	1,500	1,850	1,850	1,850	1,850	1,850	1,850	1,850
Commercial harvest (kg)			1,760	1,760	1,760	1,760	2,146	2,146	2,146	2,146	2,146	2,146	2,146
Recreational harvest (no.)			168	168	168	168	208	208	208	208	208	208	208
Total													
Total production (no.)	186,007	226,007	244,707	279,386	384,247	465,137	551,597	564,957	564,957	587,357	596,957	596,957	596,957
Commercial harvest (kg)	548,810	622,841	650,743	671,925	833,027	1,014,713	1,153,970	1,176,499	1,176,499	1,211,153	1,232,657	1,232,657	1,232,657
Recreational harvest	5,375	10,150	12,564	18,165	26,368	29,064	39,146	40,914	40,914	43,378	43,570	43,570	43,570

Table 1c. Summary table outlining preliminary total annual production and harvest flows from an implemented Salmon Enhancement Program of 20 projects in the Province of Newfoundland and Labrador.

Strategy	Year												
	5	6	7	8	9	10	11	12	13-18	19	20-23	24	25
Colonization - Pond Ranching													
Total production (no.)	22,600	44,600	69,300	113,579	218,440	332,020	372,140	406,000	410,500	444,950	464,000	484,510	493,300
Commercial harvest (kg)	23,200	67,900	97,392	139,454	300,556	530,394	604,710	657,932	668,012	717,363	760,037	783,653	803,341
Recreational harvest (no.)	3,400	6,200	7,955	13,966	22,169	28,462	31,930	35,953	36,043	39,833	40,214	42,470	42,646
Intensive Fish Culture (Provincial)													
Sea Farming													
Total production (no.)	145,407	145,407	145,407	145,407	145,407	145,407	145,407	145,407	145,407	145,407	145,407	145,407	145,407
Commercial harvest (kg)	496,280	496,280	496,280	496,280	496,280	496,280	496,280	496,280	496,280	496,280	496,280	496,280	496,280
River Stocking													
Total production (no.)	18,000	36,000	51,000	51,000	51,000	58,000	121,000	121,000	121,000	121,000	121,000	121,000	121,000
Commercial harvest (kg)	29,330	58,661	83,103	83,103	83,103	94,509	197,167	197,167	197,167	197,167	197,167	197,167	197,167
Recreational harvest (no.)	1,975	3,950	5,596	5,596	5,596	6,364	13,278	13,278	13,278	13,278	13,278	13,278	13,278
Public projects													
Total production (no.)			5,802	7,646	7,646	7,646	7,996	7,996	7,996	7,996	7,996	7,996	7,996
Commercial harvest (kg)			6,492	11,686	11,686	11,686	12,072	12,072	12,072	12,072	12,072	12,072	12,072
Recreational harvest (no.)			653	694	694	694	734	734	734	734	734	734	734
Total													
Total production (no.)	186,007	226,007	271,509	317,632	422,493	543,073	646,543	680,403	684,903	719,353	738,403	758,913	767,703
Commercial harvest (kg)	548,810	622,841	683,267	730,523	891,625	1,132,869	1,310,229	1,363,451	1,373,531	1,422,882	1,465,556	1,489,172	1,508,860
Recreational harvest	5,375	10,150	14,204	20,256	28,459	35,520	45,942	49,965	50,055	53,845	54,226	56,482	56,658

Table 2a. Summary table outlining preliminary total annual capital operation and person-year costs for implementing an Atlantic salmon enhancement program of seven projects in the western Newfoundland portion of the Gulf Region ($1984).

Strategy	Year											
	1	2	3	4	5	6	7	8	9	10	15	16 ... etc.
Colonization - Pond Ranching												
Person years (no.)	1.7	3.2	3.9	4.7	4.3	6.6	8.5	8.5	7.7	7.5	9.7	9.7
Capital (x $1000)	26.8	605,2	1.3	4.0	1274.9	-	-	-	-	-	536.8	-
O&M (x $1000)	16.1	73.8	87.2	98.2	149.0	136.9	103.3	103.3	103.3	103.3	103.3	103.3
Public projects												
Person years (no.)	9.5	12.2	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4
Capital (x $1000)	90.6	370.3	22.0	-	-	-	-	-	-	-	-	-
O&M (x $1000)	90.8	174.2	133.5	133.5	133.5	133.5	133.5	133.5	133.5	133.5	133.5	133.5
DFO Direction/Administration												
Person years (Permanent no.)	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Capital (x $1000)	29.3	15.3	16.7	10.5	21.4	23.1	27.1	27.1	25.6	24.4	24.4	24.4
O&M (x $1000)	52.2	74.2	63.2	67.1	68.3	73.7	86.9	86.9	82.1	78.1	78.1	78.1
Total DFO Projects												
Person years (no.)	13.9	19.6	15.9	16.5	16.2	18.8	21.4	21.4	20.3	19.9	22.1	22.1
(x $1000)	(292)	(412)	(334)	(347)	(340)	(395)	(449)	(449)	(426)	(418)	(464)	(464)
Capital (x $1000)	146.8	990.8	40.0	14.5	1296.2	23.1	27.1	27.1	25.6	24.4	561.2	24.4
O&M (x $1000)	159.1	322.2	283.9	298.8	350.8	344.0	323.7	323.7	318.9	261.2	261.2	261.2
Total costs	662.1	1815.6	731.4	736.6	2061.8	849.0	898.5	898.5	864.2	795.6	1388.5	851.7

Table 2b. Summary table outlining preliminary total annual capital operation and person-year costs for implementing an Atlantic salmon enhancement program of 13 projects, Newfoundland Region ($1984).

Strategy	Year 1	2	3	4	5	6	7	8	9	10	15	16 ... etc.
Colonization - Pond Ranching												
Person years (no.)	13.9	14.2	19.6	25.7	21.8	24.7	20.1	20.1	21.2	17.7	19.1	19.1
Capital (x $1000)	610.6	73.8	2618.2	1456.1	1677.5	536.8	1006.5	1274.9	-	-	134.2	-
O&M (x $1000)	102.7	230.2	296.0	353.7	345.9	446.3	333.5	333.5	310.7	242.3	253.0	253.0
Intensive Fish Culture (Provincial)												
Sea Farming												
Person years (no.)												
Capital (x $1000)		3355.0	112.2									
O&M (x $1000)		137.9	298.9	841.8	1478.6	1478.6	1478.6	1478.6	1478.6	1478.6	1478.6	1478.6
River Stocking												
Person years (no.)			1.0	1.0	2.5	3.0	3.0	3.0	3.0	9.0	11.5	13.5
Capital (x $1000)	61.0	30.5	103.1	1830.0	732.0	30.5	18.3	18.3	30.5	73.2	24.4	36.6
O&M (x $1000)				144.6	214.1	221.4	221.4	221.4	221.4	439.2	427.0	451.4
Public projects												
Person years (no.)	9.8	10.6	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9
Capital (x $1000)	116.5	8.5	228.1	36.6	36.6	36.6	36.6	36.6	36.6	36.6	36.6	36.6
O&M (x $1000)	78.7	72.0	20.7	20.7	20.7	20.7	20.7	20.7	20.7	20.7	20.7	20.7
DFO Direction/Administration												
Person years												
(Permanent no.)	10.0	10.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
Capital (x $1000)	111.0	39.7	56.5	38.3	76.3	74.5	70.5	70.5	72.0	73.2	73.2	73.2
O&M (x $1000)	197.9	191.8	213.7	245.2	244.0	238.6	225.5	225.5	230.2	234.2	234.2	234.2
Total DFO Projects												
Person years (no.)	34.0	35.6	37.9	44.2	41.7	44.8	39.5	39.5	40.9	43.6	47.5	49.5
(x $1000)	(714)	(747)	(796)	(928)	(876)	(941)	(830)	(830)	(859)	(916)	(998)	(1040)
Capital (x $1000)	899.1	152.5	3006.0	3361.0	2522.5	678.1	1131.9	1400.3	139.1	183.0	268.4	146.4
O&M (x $1000)	488.7	494.0	530.5	764.2	824.8	927.1	801.2	801.2	783.1	988.9	988.7	1013.1
Total costs	2259.0	1557.8	4507.5	5257.3	4415.9	2753.5	2945.7	3214.1	1970.2	2289.5	2474.6	2428.3
Total Sea-Farming Projects												
Person years (no.)												
Capital (x $1000)		3355.0	112.2									
O&M (x $1000)		137.9	298.9	841.8	1478.6	1478.6	1478.6	1478.6	1478.6	1478.6	1478.6	1478.6
Total costs		3492.9	411.1	841.8	1478.6	1478.6	1478.6	1478.6	1478.6	1478.6	1478.6	1478.6
Grand Total - Program												
Person years (no.)	34.0	35.6	37.9	44.2	41.7	44.8	39.5	39.5	40.9	43.6	47.5	49.5
(x $1000)	(714)	(747)	(796)	(928)	(876)	(941)	(830)	(830)	(859)	(916)	(998)	(1040)
Capital (x $1000)	899.1	3507.5	3118.2	3361.0	2522.4	678.1	1131.9	1400.3	139.1	183.0	268.4	146.4
O&M (x $1000)	488.7	631.8	829.4	1606.0	2303.5	2405.7	2279.8	2279.8	2261.8	2467.6	2467.3	2491.7
Total costs	2259.0	5050.7	4918.7	6099.1	5894.6	4232.2	4424.3	4692.7	3448.8	3768.1	3953.3	3906.9

Table 2c. Summary table outlining preliminary total annual capital operation and person-year costs for implementing an Atlantic salmon enhancement program of 20 projects, Newfoundland and Labrador 1982-2006 ($1984).

Strategy	Year 1	2	3	4	5	6	7	8	9	10	15	16 ... etc.
Colonization - Pond Ranching												
Person years (no.)	15.6	17.4	23.5	30.4	26.1	31.3	28.6	28.6	28.9	25.2	28.8	28.8
Capital (x $1000)	637.5	679.1	2619.6	1460.1	2952.4	536.8	1006.5	1274.9	-	-	671.0	-
O&M (x $1000)	228.3	304.0	383.2	451.9	495.0	583.2	436.9	436.9	414.1	345.6	356.4	356.4
Intensive Fish Culture (Provincial)												
Sea Farming												
Person years (no.)												
Capital (x $1000)		3355.0	112.2									
O&M (x $1000)		137.9	298.9	841.8	1478.6	1478.6	1478.6	1478.6	1478.6	1478.6	1478.6	1478.6
River Stocking												
Person years (no.)			1.0	1.0	2.5	3.0	3.0	3.0	3.0	9.0	11.5	13.5
Capital (x $1000)	61.0	30.5	103.1	1830.0	732.0	30.5	18.3	18.3	30.5	73.2	24.4	36.6
O&M (x $1000)				144.6	214.7	221.4	221.4	221.4	221.4	439.2	427.0	451.4
Public projects												
Person years (no.)	19.3	22.8	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3
Capital (x $1000)	207.2	378.8	250.1	36.6	36.6	36.6	36.6	36.6	36.6	36.6	36.6	36.6
O&M (x $1000)	169.5	246.2	154.2	154.2	154.2	154.2	154.2	154.2	154.2	154.2	154.2	154.2
DFO Direction/Administration												
Person years												
(Permanent no.)	13.0	15.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0
Capital (x $1000)	140.3	54.9	73.2	48.8	97.6	97.6	97.6	97.6	97.6	97.6	97.6	97.6
O&M (x $1000)	250.1	266.0	276.9	312.3	312.3	312.3	312.3	312.3	312.3	312.3	312.3	312.3
Total DFO Projects												
Person years (no.)	47.9	55.2	53.8	60.7	57.9	63.6	60.9	60.9	61.2	63.5	69.6	71.6
(x $1000)	(1006)	(1159)	(1130)	(1275)	(1216)	(1336)	(1279)	(1279)	(1285)	(1333)	(1462)	(1504)
Capital (x $1000)	1045.9	1143.3	3046.0	3375.5	3818.6	701.5	1159.0	1427.4				
O&M (x $1000)	647.8	816.2	814.4	1063.0	1175.6	1271.1	1124.8	1124.8	1102.0	1251.3	1249.9	1274.3
Total costs	2920.9	3373.4	5238.9	5994.0	6477.7	3602.5	3844.2	4112.6	2834.4	3085.0	3863.1	3280.0
Total Sea-Farming Projects												
Person years (no.)												
Capital (x $1000)		3355.0	112.2									
O&M (x $1000)		137.9	298.9	841.8	1478.6	1478.6	1478.6	1478.6	1478.6	1478.6	1478.6	1478.6
Total costs		3492.9	411.1	841.8	1478.6	1478.6	1478.6	1478.6	1478.6	1478.6	1478.6	1478.6
Grand Total - Program												
Person years (no.)	47.9	55.2	53.8	60.7	57.9	63.6	60.9	60.9	61.2	63.5	69.6	71.6
(x $1000)	(1006)	(1159)	(1130)	(1275)	(1216)	(1336)	(1279)	(1279)	(1285)	(1333)	(1462)	(1504)
Capital (x $1000)	1045.9	4498.2	3158.2	3375.5	3818.6	701.5	1159.0	1427.4	164.7	207.4	829.6	170.8
O&M (x $1000)	647.8	954.0	1113.3	1904.8	2654.2	2749.8	2603.5	2603.5	2580.7	2730.0	2728.5	2752.9
Total costs	2920.9	6866.3	5650.1	6835.8	7956.4	5081.2	5322.9	5591.3	4313.1	4563.7	5341.8	4758.6

Table 3. Table of sample benefit/cost analyses[1] for seven enhancement projects summarizing the most probable set of management/enhancement options.

Project	Total potential production	Benefit:Cost Analysis	
		Standard calculation	50% Labour credit
Exploits	66,000	0.95	1.17
Humber	17,100	1.17	1.41
Terra Nova	7,300	0.94	1.15
Canairiktok	36,500	1.20	-
Black Brook	35,600	1.41	1.72
Torrent River	56,700	1.82	2.25
South Brook	22,100	1.10	1.43
Project Aggregate	241,300	1.25	1.55

Assumptions:

1. 25 percent interceptions reduction within existing commercial fishery.
2. 10% discount levels in calculations.
3. $5.40/kg commercial value; $10.80/kg recreational value for enhanced fish.

Note:

[1]For detailed rationale on the above assumptions/analysis see Discussion Paper, Appendix G - (a) and Project Benefit:Cost Analysis which follow.

RECOMMENDATIONS

(OF THE CORE PLANNING GROUP FOR SALMON DEVELOPMENT)

In the late 1970's it was recognized by many that the province of Newfoundland and Labrador had the potential to produce far more Atlantic salmon than it currently produces and that the social and economic well being of the people of the province could be significantly improved by development of that potential.

Thus, during 1980, 1981 and 1982, the following provincial and federal agencies met to consider the desirability and practicality of immediately launching a salmon enhancement program, in the Province of Newfoundland and Labrador:

Canada Employment & Immigration Commission (Federal)
Department of Education (Provincial)
Department of Fisheries (Provincial)
Department of Fisheries and Oceans (Federal)
Department of Intergovernmental Affairs (Provincial)
Memorial University of Newfoundland
Regional Economic Expansion (Federal)
Department of Rural, Agricultural and Northern Development (Provincial)

WHEREAS the above mentioned participants noted that a salmon development program initiated in Newfoundland and Labrador could have the following positive impacts on the province:

a) improve economic well-being;

b) improve social standards;

c) provide employment opportunities and skill development for rural unemployed.

d) provide additional salmon to offset economic losses to the commercial fisheries due to the reduction of interception of mainland origin salmon by Newfoundland's commercial fishery;

e) decrease regional disparity and unemployment;

f) increase public awareness of conservation through education programs and public participation;

g) create significant benefit to tourism;

h) create significant benefit to recreational and commercial fisheries;

i) improve relationships between participating governments and the public;

j) stimulate all industries associated with the salmon fisheries (i.e. gear manufacturers, retail outlets, hotels, etc.).

IT IS RECOMMENDED THAT an Atlantic salmon development program be implemented in Newfoundland and Labrador to achieve the above.

AND WHEREAS the above mentioned impacts could be achieved through a program designed to approximately double the production of Atlantic salmon in the combined recreational and commercial fisheries through use of the following enhancement strategies:

a) colonization: (making new areas accessible to salmon and stocking these areas with salmon);

b) pond rearing: (using small lakes (or ponds) as natural rearing areas of young salmon which will go to sea);

c) intensive fish culture: (using hatcheries to rear young salmon for river stocking and to provide incentive private commercial salmon farming);

d) restoration of stocks.

IT IS RECOMMENDED THAT a mixture of these strategies be used in the implementation of the program.

WHEREAS an economic analysis of a sample of the projects considered demonstrated favourable benefit-cost ratios:

Project	Total potential production	Benefit:Cost Analysis	
		Standard calculation	50% Labour credit
Exploits	66,000	0.95	1.17
Humber	17,100	1.17	1.41
Terra Nova	7,300	0.94	1.15
Canairiktok	36,500	1.20	-
Black Brook	35,600	1.41	1.72
Torrent River	56,700	1.82	2.25
South Brook	22,100	1.10	1.43
Project Aggregate	241,300	1.25	1.55

IT IS RECOMMENDED THAT the enhancement program initiated in the Province of Newfoundland and Labrador consider the following projects*(not priorized).

Bay D'Espoir Hatchery
Black Brook Pilot
Canairiktok River
Gander River System
Humber River
Indian Bay Brook & Area
Robinson's River & Area
South Brook
Terra Nova River
Torrent River & Area
Upper Exploits River

AND WHEREAS a variety of local associations have expressed interest in sponsoring and implementing their own public involvement projects which have been determined to be technically feasible.

IT IS RECOMMENDED THAT the salmon development program include a Public Involvement component which will consider implementation of projects worthy of support, including the following which have already been received:

River System	Locality	Requesting Agency
Brian's Feeder	Portland Creek	Central Development Assoc. Parsons Pond
Colinet River	Colinet	Salmon Association for Eastern Newfoundland
Fox Is./Romaines R.	Stephenville	Salmon Preservation Assoc. of Newfoundland
Grand Lake R. (Humber R. System)	Deer Lake	Humber Valley Development Assoc. for the Waters
Hickman Harbour R.	Clarenville	Random North Development Association
Hunt/Adlatok River, Labrador	Hopedale	Salmon Enhancement Association of Labrador
Salmon Cove Brook	Carbonear	Bay Shore Rod & Gun Club
Salmon Cove/Port Union	Bonavista	Bonavista Area Regional Brook Development Association

*Certain parts of some of these government sponsored projects will be contracted out to local associations or consultants.

WHEREAS the Department of Fisheries and Oceans is responsible for management and development of Atlantic salmon stocks and is committed to conducting enhancement projects in a cost-effective manner,

AND WHEREAS other federal and provincial governmental agencies have funding programs related to improvement of social, regional development, and unemployment situations which by their nature compliment the goals of a salmon development program,

AND WHEREAS it is recognized that specific enhancement projects funded by non-Department of Fisheries and Oceans funding programs will also require an administrative expense (biological and technical guidance) to be borne by the Department of Fisheries and Oceans,

IT IS RECOMMENDED THAT the Department of Fisheries and Oceans take the lead in the preparation and implementation of an extensive program for salmon development in Newfoundland and Labrador.

AND IT IS FURTHER RECOMMENDED THAT all relevant funding agencies continue to cooperate fully in their evaluation of project and allotment of resources toward salmon enhancement to ensure that all projects implemented are incorporated into and are an integral part of the total development program for the Province of Newfoundland and Labrador.

IT IS FURTHER RECOMMENDED THAT a mechanism for refinement to initial projects and development of further projects be incorporated into the implementation of a development program and that a planning initiative be included as an integral part of this implementation thereby ensuring a dynamic and evolving program that can continue beyond the scope of the present plan whenever additional projects are proven to be socially and economically desirable.

* * * * * *

In keeping with the foregoing specific recommendations, the following general recommendation is made:

IT IS RECOMMENDED THAT AS THE LEAD AGENCY FISHERIES AND OCEANS BE GIVEN APPROVAL AND FUNDING TO IMMEDIATELY IMPLEMENT A COMPREHENSIVE 10-YEAR PLAN TO SIGNIFICANTLY IMPROVE THE ECONOMIC AND SOCIAL WELL BEING OF NEWFOUNDLAND AND LABRADOR THROUGH A SALMON DEVELOPMENT PROGRAM.

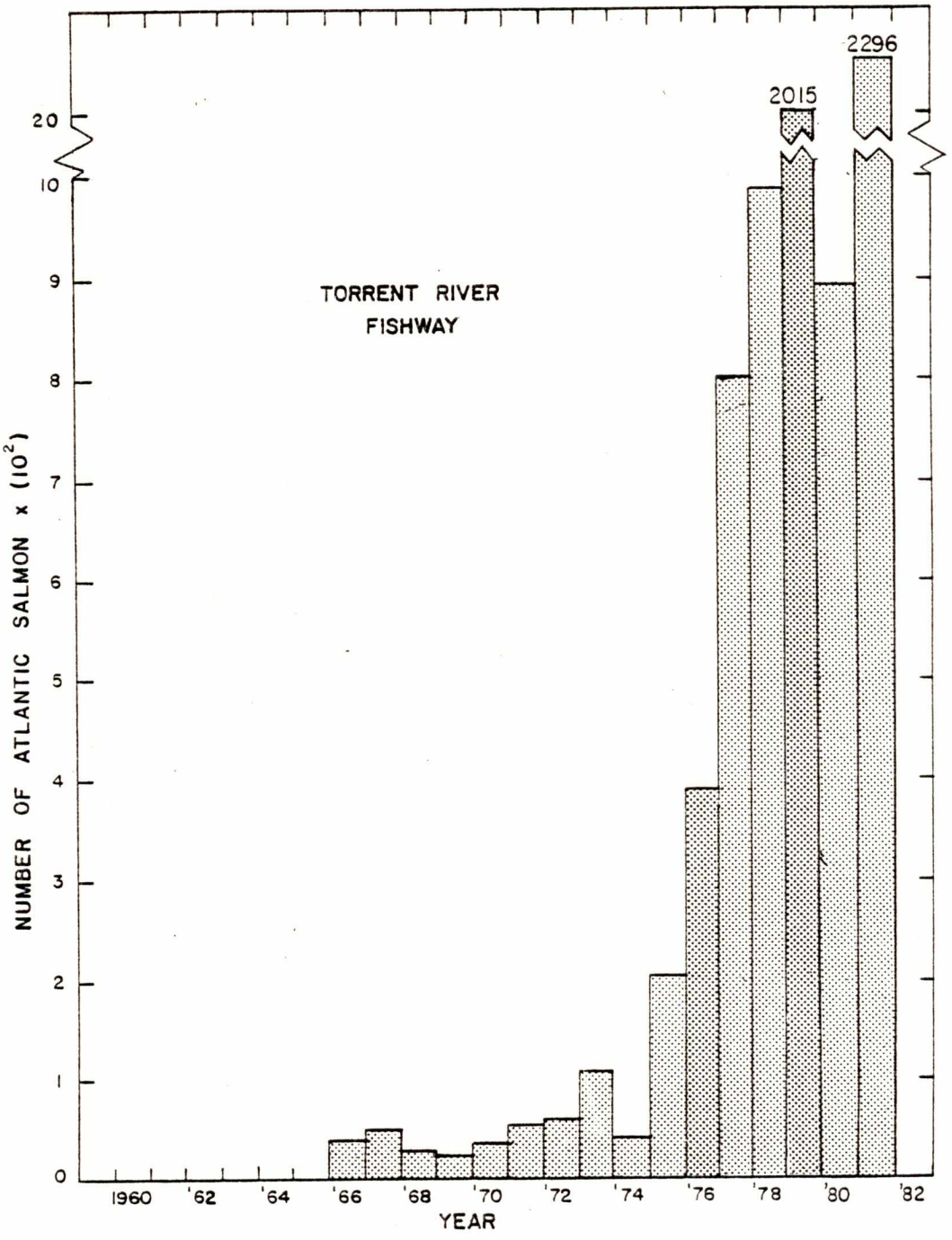
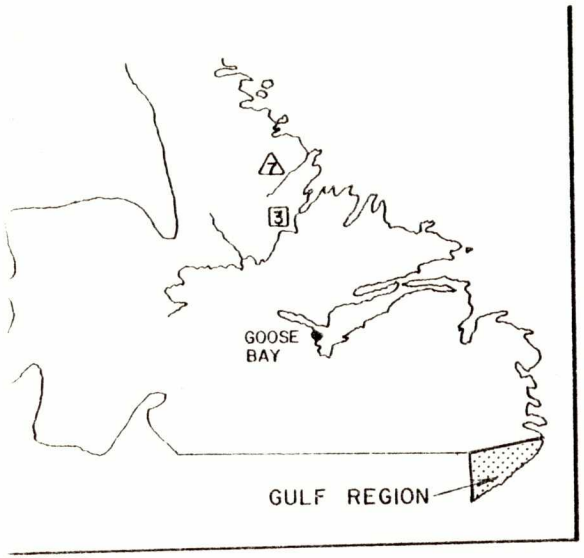


Figure 1. In 1966 a fishway was constructed in Torrent River on Newfoundland's west coast and spawning adult salmon were transplanted above the fishway from 1972 to 1976; salmon returns to this system subsequently reached unprecedented highs. This technique and modifications to it form the basis of one of Newfoundland's enhancement strategies for expansion of Atlantic salmon stocks.



□-COLONIZATION PROJECTS
1. EXPLOITS R.
2. TERRA NOVA R.
3. CANAIRIKTOK (LAB.)
4. HUMBER R.

○-POND RANCHING PROJECTS
1. BLACK BROOK
2. ROBINSONS R.
3. INDIAN BAY BROOK
4. GANDER BAY BROOK
5. TORRENT R.
6. SOUTH BROOK

△-PUBLIC INVOLVEMENT PROJECTS
1. SALMON COVE, (C.B.)
2. SALMON COVE, (T.B.)
3. HICKMANS HARBOUR
4. PORTLAND CREEK, (G.N.P.)
5. DEER LAKE
6. ROMAINES RIVER
7. HUNT RIVER, (LAB.)

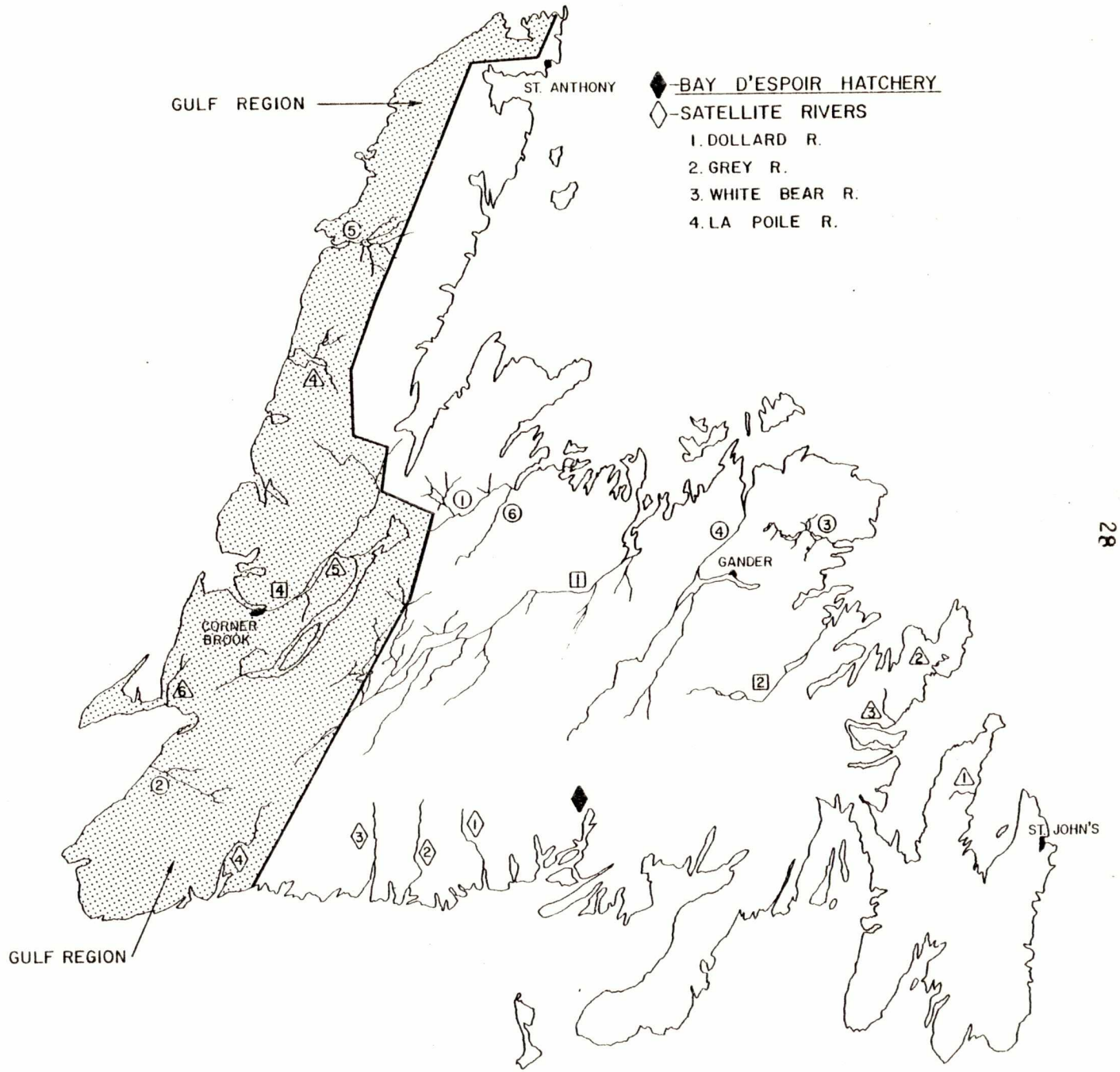


Figure 2. A total of 21 projects throughout Newfoundland and Labrador will almost double the province's production of Atlantic Salmon by the 1990's.

Figure 3. Hundreds of miles of fertile salmon habitat extending deep into Newfoundland's wilderness areas will be made accessible through an extensive salmon enhancement program.

Figure 4. Recent experiments indicate that many hundreds of Newfoundland's small lakes or ponds have the potential of naturally rearing salmon from the time they hatch until they migrate to sea; this "pond rearing" constitutes a major part of the Newfoundland enhancement program.

Figure 5. Medium-level technology egg incubators will be installed directly in this stream and enable hatching of about two and one-half million fry for distribution to fertile but inaccessible rearing habitat. This technology is ideal for systems with inadequate spawning habitat.

Figure 6. Numerous waterfalls in Newfoundland's wilderness areas are impassable to upstream migrating salmon. Many miles of fertile habitat would be available to expanded populations of salmon by installation of a fish ladder on the far left-hand side of this remote Labrador waterfall.

Figure 7. "Low level technology", such as stream clearance, is used to make inaccessible spawning and rearing habitat accessible to Atlantic salmon. Important increases in salmon populations can be achieved through such simple procedures.

Figure 8. The first year or so of some of the projects will involve detailed on-site surveying to select suitable locations for stream improvements or installation of specialized facilities (fishways, incubation chambers, accommodations, etc.).

Figure 9. "Medium level technology" is required to allow salmon populations to expand into areas above more difficult obstructions. Results from the construction of this fishway (see Fig. 1) serve as a model for the future of many salmon enhancement schemes in Newfoundland.

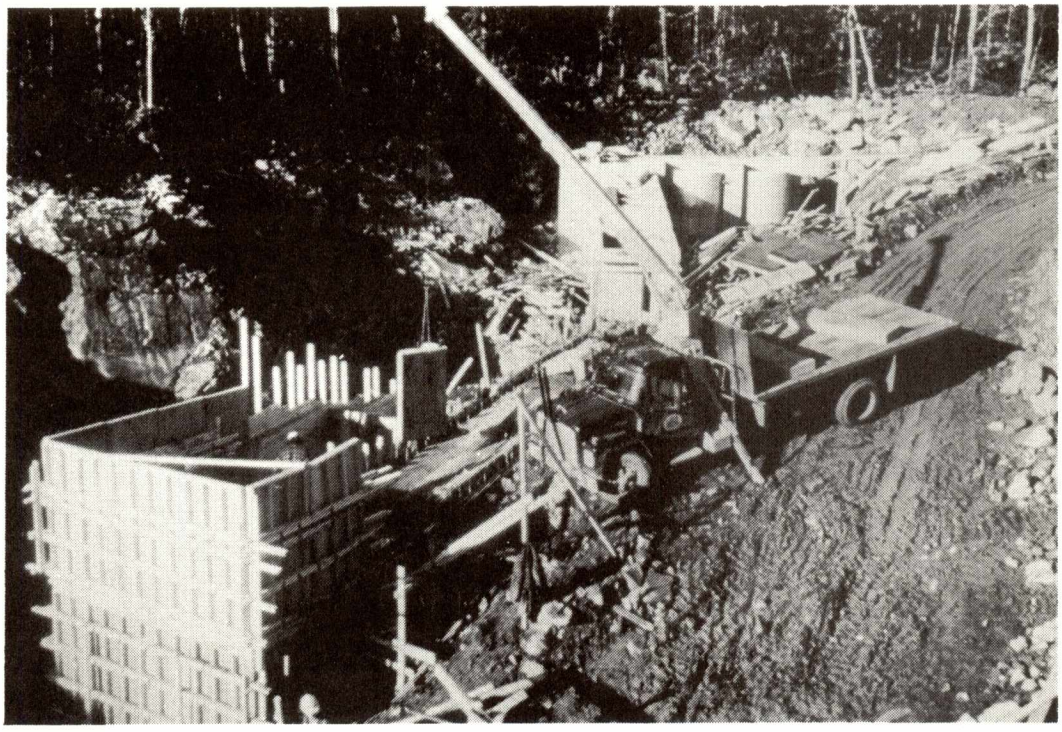


Figure 10. Labour intensive segments occur early in the life of some of the projects thereby contributing to relief of unemployment and associated social problems. Design and placement of this salmon collection facility proved to be a key element in the success of the Exploits River Development Project.

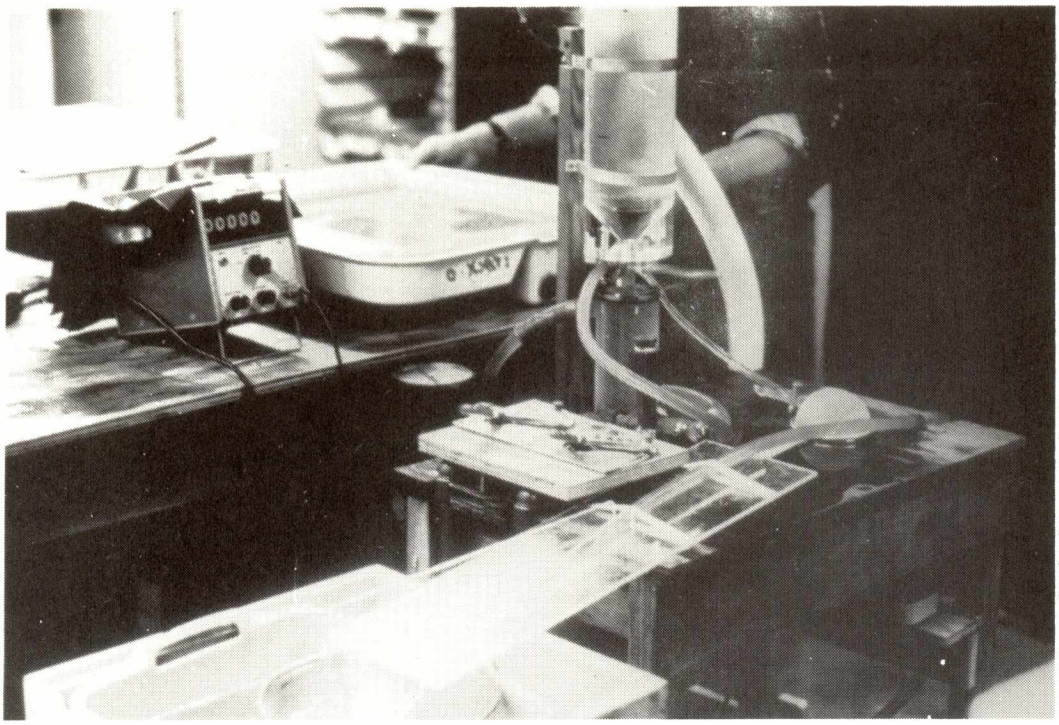


Figure 11. While the main thrust of the Newfoundland enhancement program is the application of existing and proven approaches which are economically sound, new means are continually being sought to reduce costs further.

Figure 12. Following techniques already proven for Pacific salmon, trials are already underway to greatly improve survival and growth of Atlantic salmon fry by feeding them in semi-natural rearing areas before being released into the wild.

Figure 13. Results of recent experiments performed by Memorial University's Marine Sciences Research Laboratory indicate that cage culture of salmonids in long sheltered bays along Newfoundland's south coast may be a viable enterprise if a hatchery were constructed in the area to provide a source of "starter fish".

Figure 14. Newfoundland's experience with community involvement projects has demonstrated that low level technology can be effectively transferred to the private sector to establish or rebuild depleted salmon stocks in rivers near important communities.

Figure 15. Additional protection of new and expanded salmon populations has been incorporated into Newfoundland's salmon enhancement program.

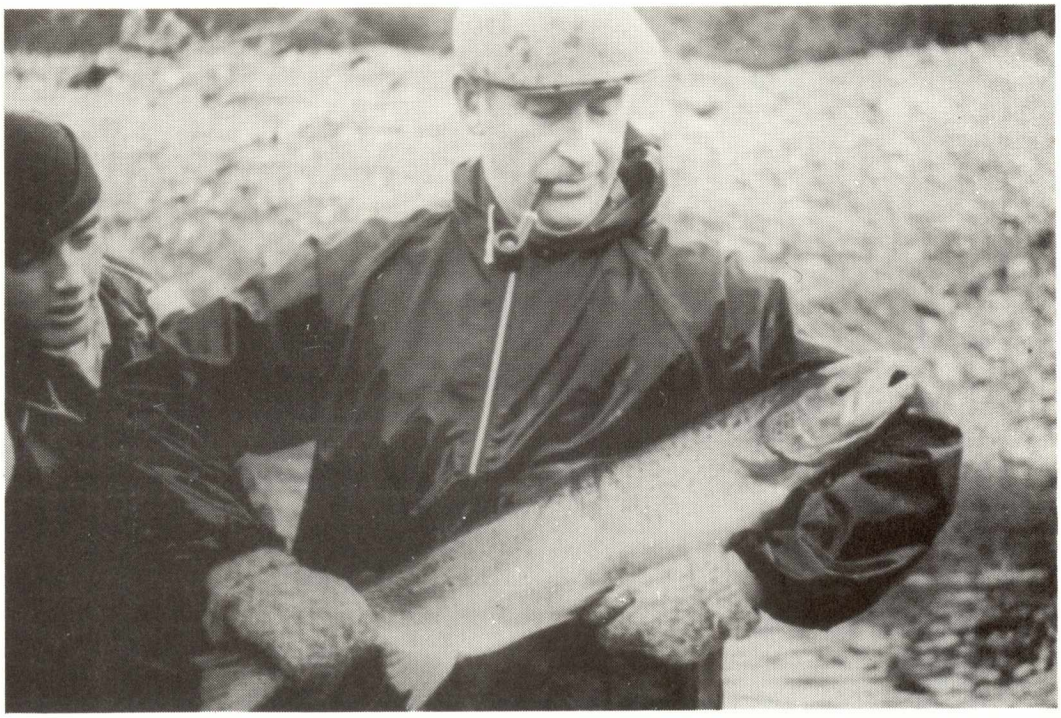


Figure 16. Newfoundland's salmon enhancement program is oriented toward the maintenance of the existing ratio between grilse and large salmon. However, where possible, selective mating of the larger salmon will be fostered to help counteract selective pressures by the fisheries against survival of these salmon.

SALMON RESOURCE DEVELOPMENT IN NEWFOUNDLAND AND LABRADOR

(Compiled by J. D. Pratt)

Fisheries Research Branch

Department of Fisheries and Oceans

St. John's, Newfoundland

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NEWFOUNDLAND-LABRADOR

THE ATLANTIC SALMON DEVELOPMENT PROGRAM,

NEWFOUNDLAND AND LABRADOR

I. INTRODUCTION

Atlantic salmon fisheries of eastern Canada could be returned to the more productive levels that existed 50 years ago. Proven enhancement included in future management could restore and nurture those important fisheries. With this realization federal and provincial agencies with interests in salmon have assembled a plan of salmon development for Newfoundland-Labrador as one component of an eventual national program for Atlantic Canada. The major objectives of special Core and Technical Planning Groups responsible for the planning were:

1. To improve the social and economic well-being of the people in the Province of Newfoundland through increased production of salmonid fish species leading to increased employment opportunities during the construction phase and sustained employment thereafter by on-going projects, and increased fishing opportunities and support services.
2. To create significant benefits to tourism and related commercial industries.
3. To foster improved public involvement and create better public awareness of conservation practices.
4. To develop new and improved approaches to salmonid management through technological and biological advances in the developmental phase of the Program.

The Terms of Reference for the Planning Groups are detailed in Appendix A.

For the purposes of this overview, the definition of enhancement developed by the 1978 Atlantic Salmon Task Force is provided:

> "Salmon enhancement, habitat protection and fisheries regulation are components of salmon management. Enhancement includes those activities which increase the availability of adult salmon by technical measures which lead to the establishment or expansion of the supply of juvenile salmon above present production levels. Methods and techniques used in salmon enhancement work may include fishway construction, stocking from fish culture stations, semi-natural rearing, adult transfers, barrier removal, gravel incubation, spawning channel operation, habitat improvement in marine and freshwaters, and others".

II. BACKGROUND

A. Description of the Atlantic Salmon Resource and its Fisheries

The Atlantic salmon (Salmo salar) is distributed throughout the province from Davis Inlet in Labrador, southeast to the Avalon Peninsula rivers

on the Island of Newfoundland. Presently there are 40 to 50 major rivers which contain significant populations of Atlantic salmon and another several hundred streams supporting smaller populations.

Atlantic salmon are anadromous, spending usually three to seven years in freshwater before migrating to sea. After one to three years feeding in the Atlantic Ocean, adult salmon return to their natal rivers to spawn, at which time they encounter various fisheries. Some Atlantic salmon do not die after spawning but often return two or three times to reproduce. The two major types of adult salmon entering the rivers and fisheries are grilse (less than 2.7 kg) and multi-sea-winter salmon (fish over 2.7 kg).

Native people, commercial fishermen and recreational fishermen are recognized as users of the Atlantic salmon resource. In Newfoundland about 5300 licensed commercial fishermen now harvest approximately 2000 metric tons annually within the inshore fishery, while about 40000 anglers harvest an additional 40000 fish each year. Native peoples in Labrador composed of North American Indians and Inuit, can harvest salmonids under a system of special permits. Approximately one-sixth of the present world and 90% of the Canadian commercial salmon catch is taken in the Newfoundland-Labrador inshore areas, located along the major adult migration routes, where there is an intermingling of different provincial stocks. About 40 percent of all salmon caught, within the Canadian recreational fishery, are currently taken from about 160 scheduled streams of Newfoundland-Labrador.

The Atlantic salmon in Newfoundland has shown signs of decline over the past century, especially in the smaller watercourses. Overfishing, poaching, hydroelectric development, industrial and municipal pollution and forest spraying continue to threaten the abundance of the resource. Newfoundland first experienced increased industrial development activities during the late 19th century within the insular watersheds with the first pulp and paper industry and associated hydro power developments. Overharvesting of stocks in the 1960's, both within Canadian waters and the distant fisheries of West Greenland, led to near collapse of several stocks. By the early 1970's, mechanization of the forest industry, establishment of an Island-wide highway transportation system and a hydroelectric grid further impacted on salmon habitat.

B. The DFO Proposal for Improved Fisheries Management

Despite gradual rehabilitation of certain Newfoundland Atlantic salmon stocks, a complex assortment of common and often interrelated management problems were subsequently identified within the other Atlantic provinces which required national, coordinated attention on the species. Since 1978, various interregional and Ottawa planning committees have addressed such pressing problems as increased angling, poaching, commercial bycatch, Indian food fishery violations and the West Greenland Fishery; of particular concern has been continuing commercial interceptions, within various provincial mixed-stock fisheries with specific reference to the Newfoundland Inshore fishery exploitation, of Maritime and Quebec origin salmon. A major shift in policy was announced in early 1980 including provincial fishery restrictions, management-consultative systems and international controls or agreements. These measures are now being pursued within the Regions.

The special resource conservation, management and economics planning committees on salmon recommended Ministerial consideration of an economic development approach which would increase and improve fisheries benefits through the integration of a comprehensive, long-term development program. After two decades, several enhancement techniques have successfully undergone experimental pilot and production scales of testing. Such proven techniques as fishways, stream clearance, adult transfers and swim-up fry stocking are now available upon which to develop strategies that would allow doubling or tripling of the present Atlantic salmon present stock base and fisheries harvest. Closed pen rearing and pilot projects are also showing promise for future salmon sea farming within southern areas of the Island. As a result, since July 1980, special federal-provincial enhancement planning groups have been established in order to assemble a 10-year program for development of the salmon stocks of Newfoundland.

If proposed Atlantic salmon management excludes extensive development, then the plan will not meet future demands for this valuable species within stable fishing regimes; nor will it remedy expected serious socio-economic dislocations in the fisheries, curb continued environmental degradations or expand the salmon resource to rivers with potential for cost-effective development of salmon production.

Current fisheries restrictions are oriented towards reducing interceptions by 25% of Maritimes-Quebec salmon stocks which compose one of four fish taken within the present Newfoundland commercial inshore salmon fishery. These measures will greatly modify future interprovincial harvest allocation policy with respect to national fisheries and spawning escapements. Although the restrictions will improve the salmon supply to established Maritime-Quebec fisheries and spawning escapements, it will result in concurrent harvest shortfalls, within the southeast and northeast areas of the Newfoundland inshore fishery. Social and economic hard-ships will subsequently be created within the coastal communities, where alternate employment is not available. Moreover the release of mainland-origin stocks results in further appreciable escapement of harvestable Newfoundland origin stocks from the inshore fishery, into insular rivers. It may prove impractical to modify the existing inshore salmon fishery so as to effectively absorb the harvestable surplus. However the application of enhancement in Newfoundland rivers could compensate those restricted coastal fishermen through added production. Enhancement could also create new river mouth and terminal fisheries which through intensive management and harvest at new facilities would discretely crop any enhanced surplus over spawning needs that is released from the inshore area. Preliminary analysis shows that increased enhancement in appropriate watersheds could effectively remedy most of the major potential inshore fishery shortfalls while allowing a flexibility to design new optimized estuarial or river fishing plans to absorb the excess production.

Salmon development technology could also be directed to restoring and maintaining stocks that were threatened, or continue to face habitat encroachments characteristic of the more densely populated, industrialized areas of the Island. However, remedial or rehabilitative advantages of enhancement should not overshadow its most important potential role: namely improving yield, quality and stability of marine and freshwater salmon

fisheries throughout the province with increased income, employment and regional development. The course of action recommended, therefore, is to supplement improved management with a program which includes extensive salmon development to meet national priorities. If this strategy is implemented on an appropriate scale and schedule, it will be possible to not only maintain, but also to rapidly increase, Atlantic salmon populations and future harvests.

C. The Role of Salmon Development in Newfoundland-Labrador

A comprehensive Atlantic salmon development thrust could more than double current production benefits to existing and newly developed fisheries by applying a technology that involves rehabilitation of formerly productive areas, opening of new habitat, hatchery stockings with juvenile salmon or release of unfed or fed fry hatched within deep substrate incubators. In addition, the undertaking would allow vital research into genetic strains and stock components as the first step towards maximizing quality and production of the resource. River enhancement would reduce annual fluctuations in salmon harvest by expanding the resource base to a larger number of watersheds.

Insular Newfoundland and Labrador are biologically dissimilar from the freshwater and anadromous fisheries point of view. Whereas development techniques have been applied successfully on the island, application of these techniques to Labrador has not happened due to greater operating costs in this area. These costs will be offset by the important economic and social benefits gained by inhabitants of coastal Labrador who have few non-fishery alternatives of income. There are numerous watersheds where cost-effective enhancement could be employed.

(1) The major beneficiaries

(a) Commercial fisheries

The commercial fishery for Atlantic salmon from 1910 to 1980 indicates the yearly catches in the decade between 1925-35 were the highest and on average were significantly higher than the current level. The Planning Groups consider that a feasible development undertaking could be designed on a scale which would maintain production somewhat above the former peak levels, i.e. an additional 2000 metric tons of annual catch would be available. This would represent an increase in landed value revenues of over $6 million (in $1981) by the year 1992 (i.e. from 6 million to $12 million annually) with the retail value almost twice that figure.

During the last decade, the landed value of Atlantic salmon to fishermen has more than tripled and the fishery currently contributes fully one quarter of annual income for many inshore fishermen. As the price has increased, the relative importance to other fisheries also increased. Furthermore, Newfoundland's coastal communities rely heavily on salmon resources since there are few other sources of income; for example about one half of the Labrador fishery revenues are attributed to salmon.

Presently, about two-thirds of the annual commercial harvest of Atlantic salmon is marketed fresh on local or domestic markets while most of that remaining is exported in frozen form; a minimal amount is smoked, pickled or canned. Preliminary marketing analysis indicates that domestic and export demands, for enhanced salmon production, will remain elastic although the marketplace may prove subject to periodic price depressions (Appendix E(a)). Since smoking and pickling currently command very high unit prices, their further market development holds promise for dampening any widespread price depressions of an expanded fishery.

(b) Recreational fisheries

A recreational fishery, with an increased supply of large salmon, would improve quality, success and interest in angling throughout the province. The demand for recreational fishing has grown in recent years as a result of human population increase, improved transportation networks and increased incomes. The fishery now has an angling pressure of over 120000 rod days compared to 35-50000 in the early 1960's. While the increased effort has raised overall catch totals, and contributed to more even distribution of revenues circulated within the Newfoundland economy, harvest quality has continued to decline on most rivers in terms of the catch rate and the frequency of large salmon.

Management would therefore stress harmonious development of new recreational fishery regimes which allocate the river harvest surplus, resulting from both interceptions reduction and enhancement thrusts, within the existing and newly opened watershed fishing areas. Social and economic criteria will be used to optimize numbers, success rates and creel quality throughout all river catching areas. Enhancement will be especially appropriate within the plan, when future demands are forecast to exceed the natural supply. For example, on the east coast where salmon river rearing capacity is lower than other less densely settled parts of the province, a greatly increased demand for recreational fishing is expected. The human population growth rate should double adding to the peninsula 30,000 new people with lifestyles especially amenable to angling.

The most favoured enhancement target is an added production of 50,000 fish that would be allocated to both existing and newly developed river angling areas. This would roughly represent a doubling of the number within existing recreational fisheries.

(c) Native peoples

The British North America Act assigns exclusive responsibility for native people to the federal government while the federal Indian Act and regulations made thereunder further define the trustee-ship relationship between the federal government and status Indians. Current Fisheries and Oceans policy on Indian food fisheries in Canada indicate that the needs of native peoples are the next priority after salmon conservation.

The 1949 Terms of Union between Canada and Newfoundland, however, did not allow for status rights for natives, although native groups are currently making representations to establish entitlements similar to natives in other parts of Canada. There are no native food fisheries recognized by the Province at this time, pending conclusion of consultations between governments and native groups.

Regardless of their status, however, native involvements in salmon development could become important especially in remote areas where opportunities for improving income, employment, regional development and education are low. Dialogue and cooperation between Government and native groups concerning the aboriginal rights issue could also be expected to improve as a result of participation in such joint ventures. The Labrador native Naskaupi and Inuit peoples have demonstrated interest in the development of new salmonid fisheries; the Conne River Indians of south coast Newfoundland have made representations to provincial agencies respecting their potential involvement in the marine pen rearing of salmon.

(d) The public

Salmon enhancement presents an excellent opportunity for the conservation-minded public to become involved in the actual planning and conduct of its own projects. Enhancement planners are considering restorative thrusts that draw heavily on volunteer and community groups. This approach directly assists DFO in the design and operation of projects. Outside participation serves also to inform and educate residents concerning the need for resource development, environmental preservation and for pertinent government controls.

Because of the simplicity of many of the proven or near-proven enhancement strategies, low-capital projects are expected to be a major DFO consideration. Such projects include fishway- and stream-remedial activities, colonization and pond ranching with the public and community involved in employment-intensive operations.

The inclusion of communities in long-term enhancement ventures provides new avenues of economic fisheries development. This will provide net monetary income generation as well as employment-development within remote areas of the provinces where seasonal unemployment may reach as high as 70 percent. In addition to these benefits, community workers will receive substantial manpower development benefits such as new skills increase in self esteem, development of leadership ability and increased mobility. As already mentioned, native peoples in remote communities of Labrador would be encouraged to take part in enhancement projects which would allow life styles more in keeping with their cultural heritage.

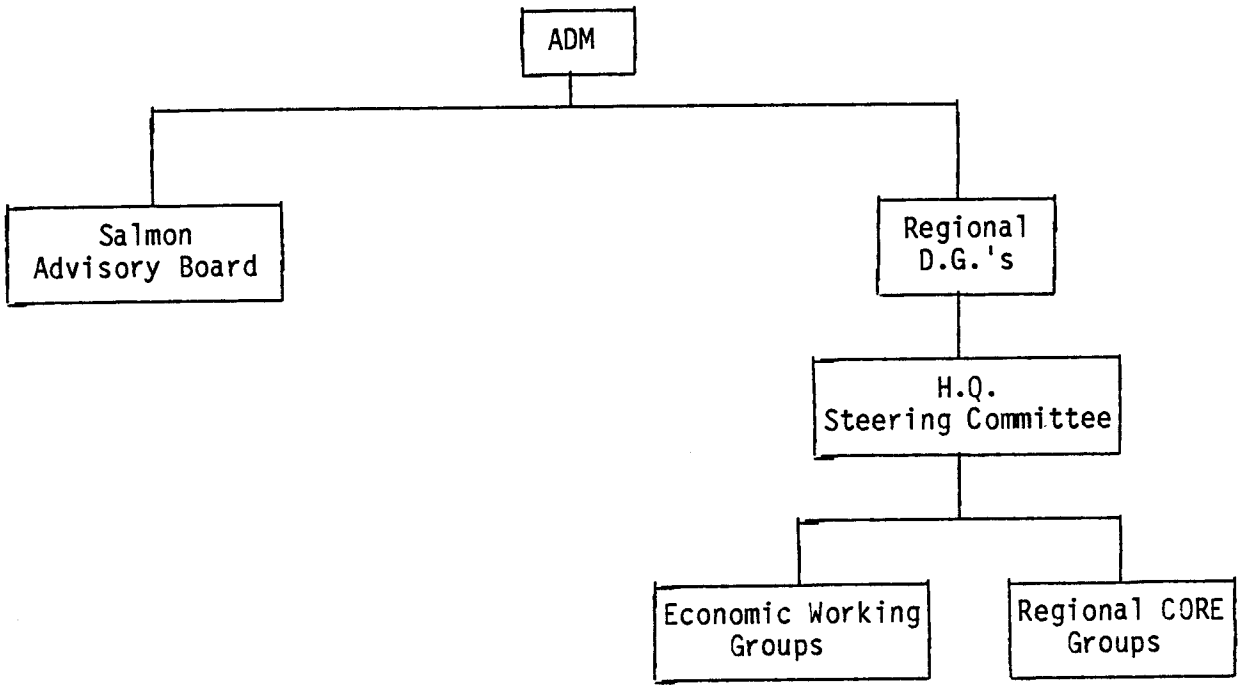
The Provincial Department of Rural, Agricultural and Northern Development has encouraged the development of an administrative network of some 49 Regional Development Associations (representing 500 communities) which are targeted at improving the social and economic wellbeing of their respective geographic regions. Because of their community development

APPENDICES

APPENDIX A

Background to the Enhancement Planning Initiative;

ORGANIZATION FOR PLANNING AN EAST COAST ENHANCEMENT PROGRAM



Organization for Newfoundland

CORE Group - Membership, January 1981

J.H.C. Pippy, Program Head, FAFP, DFO (Chairman)
J. D. Pratt, RDS, DFO (Secretary)
C. Fisher, Economics Branch, DFO
T. R. Porter, Salmon and Charr Section, DFO
R. J. Wiseman, Experimental Ecology Program, DFO
G. Snow, Conservation and Protection Branch, DFO
H. Squires, Provincial Dept. of Fisheries
D. Hustins, Parks Division, Dept. Culture, Recreation & Youth
D. Idler, Marine Sciences Research Laboratory
D. Dyer, LEAP Program, Canada Employment and Immigration Commission
L. Cashin, Dept. Regional Economic Expansion
W. Ullah, Consumer Affairs and Environment
D. Brown, Provincial Dept. Intergovernmental Affairs

Technical Working Group

J. D. Pratt, DFO (Chairman)
V. Pepper, DFO - Modelling
J. Mercer, DFO - Economics
R. Goosney, DFO - Engineering
T. R. Porter, DFO - Management Research
L. Rowe, DFO - Field Services
H. Bain, DFO - Multi-Water Use
A. Sutterlin, MSRL - Aquaculture
J. Davis, DFO - Public Involvement

Terms of Reference, Core Planning Group

Atlantic Salmonid Enhancement, Newfoundland

1. Reporting to a National Steering Committee (Organization attached) provides a forum for federal-provincial and interdepartmental exchanges for development of policy, understandings and agreements towards co-operative planning and support of a program in the area of salmonid enhancement, including aquaculture.

2. Formalizes a long term plan of implementation of salmonid enhancement for the province with respect to production, costs and overall technical and socioeconomic suitability for submission to Federal Cabinet and Treasury Board.

3. Provides general planning direction to the Technical Working Group (Organization attached) and the Geographic Working Groups during the setting of enhancement production targets, review of opportunities and the definition, refinement and priorization of projects.

4. Insure the integration of enhancement projects with management and fishing plans.

/kh

MEMORANDUM OF UNDERSTANDING BETWEEN THE MINISTER OF STATE FOR FISHERIES FOR CANADA AND THE MINISTER OF FISHERIES FOR NEWFOUNDLAND TO LEAD TO DEVELOPMENT OF PLANS AND PROGRAMS FOR A COMPREHENSIVE SALMONID ENHANCEMENT PROGRAM PROPOSAL

WHEREAS the Ministers met on to discuss the concept of a salmonid enhancement program and recognized the potential for a doubling of the production of Atlantic salmon, and for the possible enhancement of other salmonid species through aquaculture and the possible introduction of non-indigenous species; and that they undertook to consult and cooperate in the planning of a salmonid enhancement program; and

that the Government of Canada has committed funds and staff to salmonid enhancement planning programs in 1980/81 and 1981/82; and

that the Government of the Province of Newfoundland has also committed resources for planning a salmonid enhancement program; and

that negotiations should be undertaken to develop suitable federal/provincial arrangement for salmonid enhancement to set forth in explicit terms the commitments and responsibilities of both parties and the nature and extent of their financial contributions to such a program; and

that complementary policy objectives should be developed as a basis for evaluation of the benefits and costs; and

that these complementary policy objectives should be consistent with the goals of the two governments for regional development.

THEREFORE the Ministers agree that:

1. The recently established federal/provincial core group will direct the planning and programming necessary to develop a comprehensive salmonid enhancement program proposal and recommend suitable federal/provincial arrangements to implement the program;

   a) The Program Head, Freshwater and Anadromous Fisheries Management Newfoundland Region of the Department of Fisheries and Oceans, Canada, will chair the core group;

   b) the core group will consist of officers of the Department of Fisheries and Oceans and of other Departments of the Government of Canada, and of officers of the Department of Fisheries and of other Departments of the Government of the Province of Newfoundland as required to undertake any activities it considers necessary to further the purposes for which it exists.

..../2

2. The planning costs may be met by each government on a basis which reflects their respective interest in specific study activities, and technical staff will collaborate in both the planning and undertaking of studies.

3. This Memorandum of Understanding shall be in effect from the date of signing by both Ministers and may be reviewed and amended at any time by mutual consent.

IN WITNESS THEREOF,

For Canada

_____
Minister of State - Fisheries

For Newfoundland

_____
Minister of Fisheries

Dated at St. John's, Newfoundland _____

SALMONID DEVELOPMENT IN NEWFOUNDLAND AND LABRADOR

Interagency Funding Strategies to Support the Long-Term Salmonid Development Plan

A. Description of The Ten-Year Plan For Atlantic Salmonids.

The proposal is based on four cost-effective resource development strategies; the plan is comprised of 21 projects ranging from simple stream clearance and stocking to establish naturally-propagating salmon populations through to hatchery propagation - mainly in support of sea farming. Contractual arrangements with public and community groups would be the major mechanism of implementation. The program would practically double the stocks of Atlantic salmon with a resultant expansion of commercial and aquaculture returns by over 1500 metric tonnes while recreational fisheries would increase by another 50,000 adults. The ten-year program would provide direct annual employment for 250-300 people. The total cost of this program would be $45M, including the annual cost of 16 CFT employees. Follow-on annual costs after 10 years would be $3.9M and 16 CFT person years. Further details on benefits and costs are presented in Table 1 and Figure 1.

More detailed discussion and possible alternatives to full implementation of the 10-year plan are presented below.

B. Demonstration Phase For The Plan

From 1980 on, seven of the 21 projects were either significantly advanced (i.e. Exploits and Indian rivers) or initiated for the first time (i.e. Bay d'Espoir hatchery, St. Mary's North, Barry's Brook, Terra Nova River and Canairiktok River). This was accomplished through CEIC employment contracts under Job Creation/LEAP, funding from provincial agencies such as Rural Agriculture and Northern Development (RAND), and by limited resources (seed money) from existing DFO budgets. However, in the absence of a recognized program with significant resource input, total benefits from these projects will be low.

An alternative to both the existing program of core projects and to full implementation of the plan would be a demonstration phase to refine the strategies and eventually deliver 30% of the Plan's benefits. About one third of the activity would be aquaculture ventures spearheaded by provincial agencies with RAND and Provincial Fisheries anticipating contributions of $2M over the next two years (as outlined in a recent submission now under review by the Newfoundland Cabinet). If new budgetary resources are not realized for the DFO river enhancement component by 1985/86, then implementations on four of the six river enhancement projects will be affected: the upper Exploits River (which would not be fully developed), Terra Nova River, Canairiktok, and Barry's Brook.

C. Flexibility of Application of The Master Plan

Increased river enhancement and/or aquaculture in appropriate salmon management situations could compensate for many major commercial fishery cutbacks now expected from current and anticipated fishing plans. For example, a total of $18M, including 9 CFT annually, supporting 10 projects over 10 years would offset many current inshore fishery shortfalls (with annual follow-on cost after that of $910K, plus 9 CFT person years); an alternative approach would target specifically on the South Coast Fishery ($7M plus 7 CFT annually). Due to the flexible nature of the plan, it can be easily tailored to meet various specific monetary or social demands associated with the fishery.

D. Funding Options For The Plan

1. Outside Agency Support

(a) Canada Employment and Immigration Commission (CEIC)

The basis for CEIC interest in the federal/provincial plan for aquaculture and river enhancement is the apparent potential for significant employment development. Communities and sponsors with whom the Commission has traditionally dealt have displayed considerable interest in several facets of the salmonid enhancement strategies. Consequently several project proposals have already been funded during the three-year membership of CEIC within the CORE Enhancement Planning Group; with recent increasing interest in aquaculture activities, experimental observations on the possibility of sea farms at Bay D'Espoir are being actively pursued by Provincial Fisheries and RAND, with the cooperation of DFO. Demonstration projects are also being mounted at four other locations.

The support and assistance that CEIC can provide to aquaculture and enhancement components in the Plan would be through employment development programs such as LEAP and Canada Works, and would include appropriate training programs. Although specific identified allocations are not possible within programs for resource development, the above programs have expended an estimated $2,000,000 towards core enhancement projects.

A strong cooperative relationship has gradually developed to the mutual benefit of both CEIC and DFO. Under such favourable circumstances, CEIC anticipates involvement in salmonid enhancement and aquaculture development in the medium term at least.

(b) Rural Agriculture and Northern Development (RAND)

RAND provides technical information and financial services to a unique network of 53 incorporated Regional Development Associations with mandates to plan and develop local areas. With respect to its growing interest in salmonid resource development, RAND is pursuing a commitment

of a total of at least $4.0M in the medium term; a 2-year (1984-86) submission currently before the provincial cabinet is recommending a $1.3M program to support aquaculture including business incentives, training, education and technical exchange packages, and includes a capital grant ($400,000) to commence construction of a hatchery at Bay D'Espoir. In addition to the $1.3M, and included in the overall budget of $4M, a further $1.6M would be required to complete the hatchery on the longer term. RAND regards cooperation with DFO to be essential in the total development of this hatchery, given the over-lapping jurisdictions and the province's on-going commitment to salmonid enhancement.

In the event of a new Rural Development Agreement, a further $1.0M would be available for long-term development of area resources; six river enhancement projects of the Ten-Year Plan under sponsorship of development associations would be candidates for further funding consideration by RAND.

(c) Provincial Department of Fisheries

Aquaculture involvements with Atlantic salmon, speckled trout and Arctic charr are the major interest of this agency in the salmonid development plan. In a recent report to Provincial Cabinet, recommendations included development of information on potential aquaculture sites, research, development studies, and the setting up of an inter-agency aquaculture advisory board and extension services. As lead agency it would cooperate with various federal and provincial agencies on joint research, technology, extension and training services. A budgetary increase of $80K is being requested to support the above activities.

(d) Federal Department of Regional Industrial Expansion (DRIE)

DRIE representatives have indicated that it supports the development plan in principle. If the plan should be implemented, then that agency could foresee later involvements in connection with additional processing required for the expanded harvests.

E. Follow-On Costs

According to Table 1, annual follow-on costs of the total federal-provincial plan would total $3.9 million with about two-thirds of the cost attributed to river enhancement. The annual follow-on costs of the total plan (i.e. $3.9M) compare with annual follow-on revenues of $2.7M created through direct sales of fish produced by sea farmers (Fig. 1), plus $6.7M of harvest revenues to common property commercial and angling fisheries.

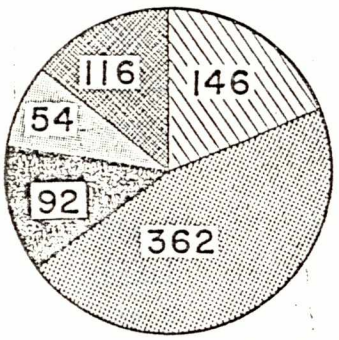
The $2.7M in direct aquaculture sales would more than offset the follow-on costs of sea farming. In the case of the river enhancement component, a defrayal of a portion of the $2.7M follow-on costs is presently under review by DFO and could involve sales of enhanced fish returning to

rivers which are surplus to fishery and spawning needs. In fact $1.2M of these follow-on costs of the plan could be gained yearly by project sponsors from sales of such surplus returns to river enhancement facilities. Many river ranching strategies would be quite amenable to such a cost-defrayal approach as examplified in Fig. 2 (i.e. Black Brook project: follow-on cost = $80K per annum; terminal harvest sales = $70-140K per annum). It is also suggested that such a cost-defrayal system would also foster greater outside agency funding support of both start-up and follow-on costs of river enhancement because of revenue return implications for specific projects. Inter-agency administrative agreements and understandings (i.e. towards reciprocal programs on coordination, training, special grants, etc.) could also address such a cost-defrayal system. The remaining $1.5M could conceivably be sourced from the $5.4M annual revenue expected from increased common property harvest (e.g. levees, increased licence fees, etc.).

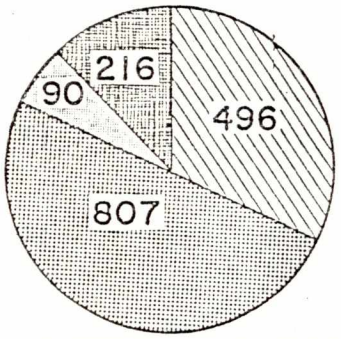
Table 1. Summary of budgetary requirements of the long-term Salmonid Development Plan and the demonstration phase ($1981).

Description	Yr 1 - 5 O/M (total)	Yr 1 - 5 CFT (annual)	Yr 6 - 10 O/M (total)	Yr 6 - 10 CFT (annual)	Annual follow-on O/M	Annual follow-on CFT
Demonstration phase						
DFO	7,823	5	7,424	5	1,262	5
Province	6,314	—	6,060	—	1,212	—
	14,871	5	13,484	5	2,474	5
Ten-year plan						
DFO	19,675	16	14,325	16	2,688	16
Province	6,314	—	6,060	—	1,212	—
	25,989	16	20,385	16	3,900	16

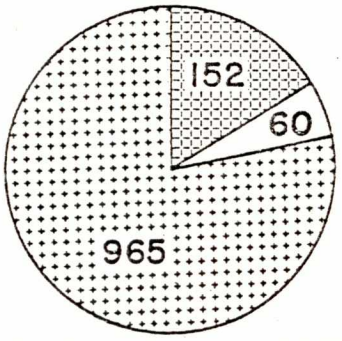
STOCK/HARVEST ALLOCATIONS & REVENUES
SALMONID DEVELOPMENT PLAN



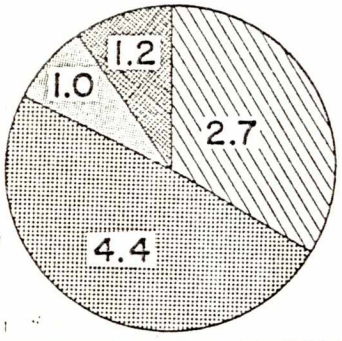
TOTAL NO. OF FISH PRODUCED
(770 K ADULTS)



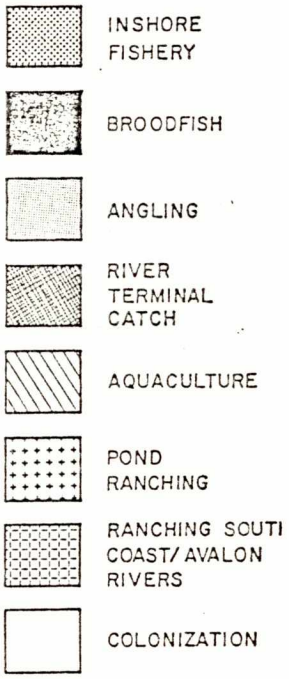
HARVESTABLE PRODUCTION
(1610 K KG)



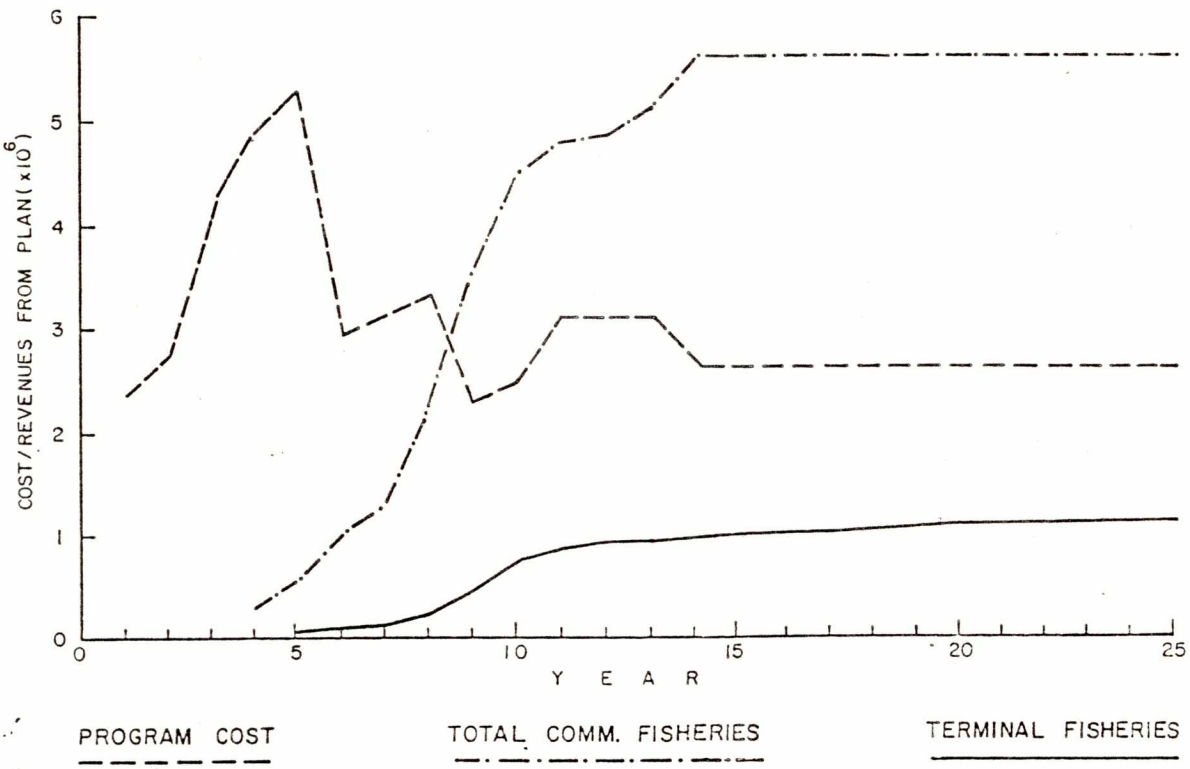
REVENUES FROM TERMINAL
FISHERIES ($ 1.18M)



HARVESTABLE PRODUCTION
REVENUES ($ 9.4M)



FISHERY REVENUES & PROGRAM COSTS
COLONIZATION & RANCHING PROJECTS



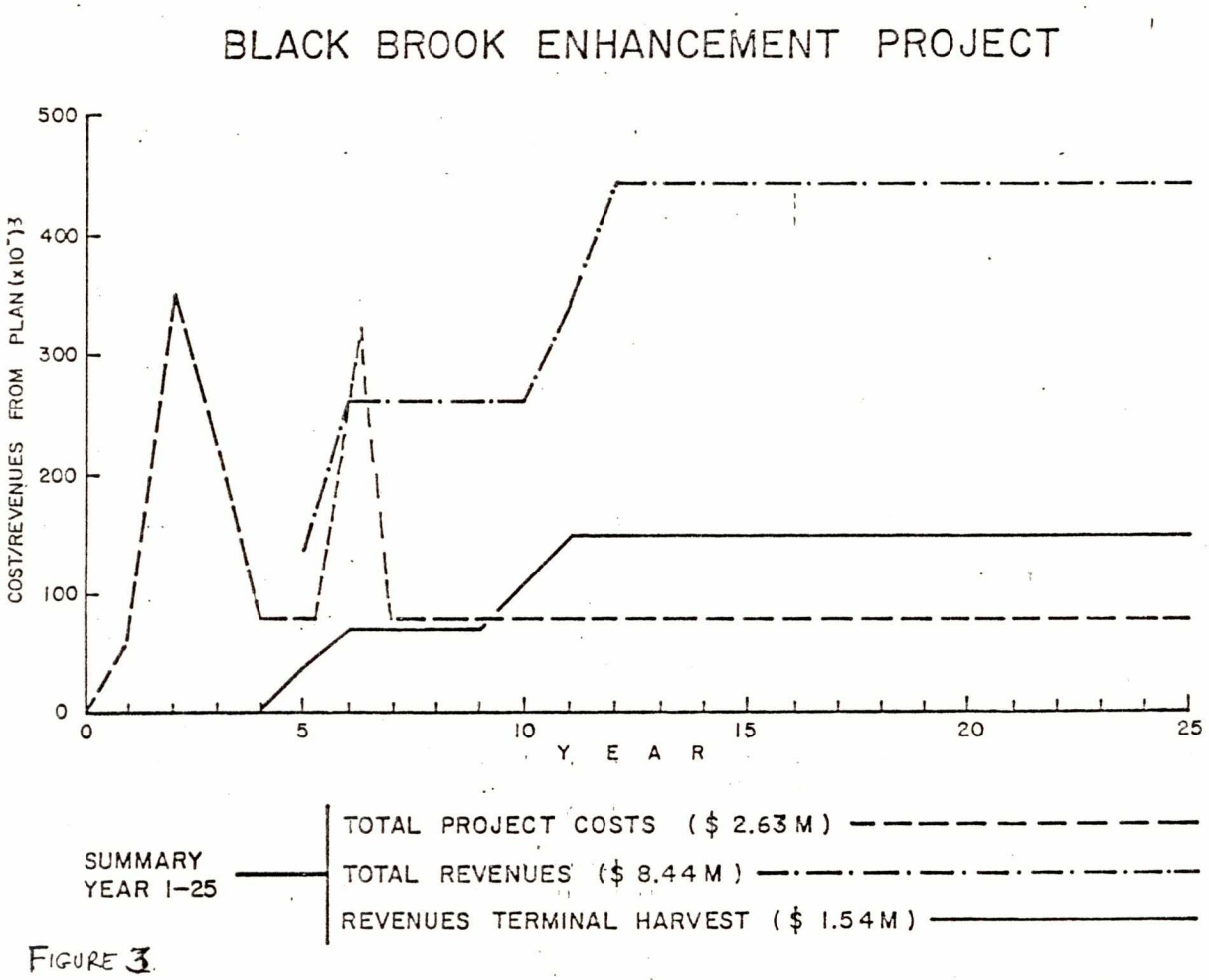
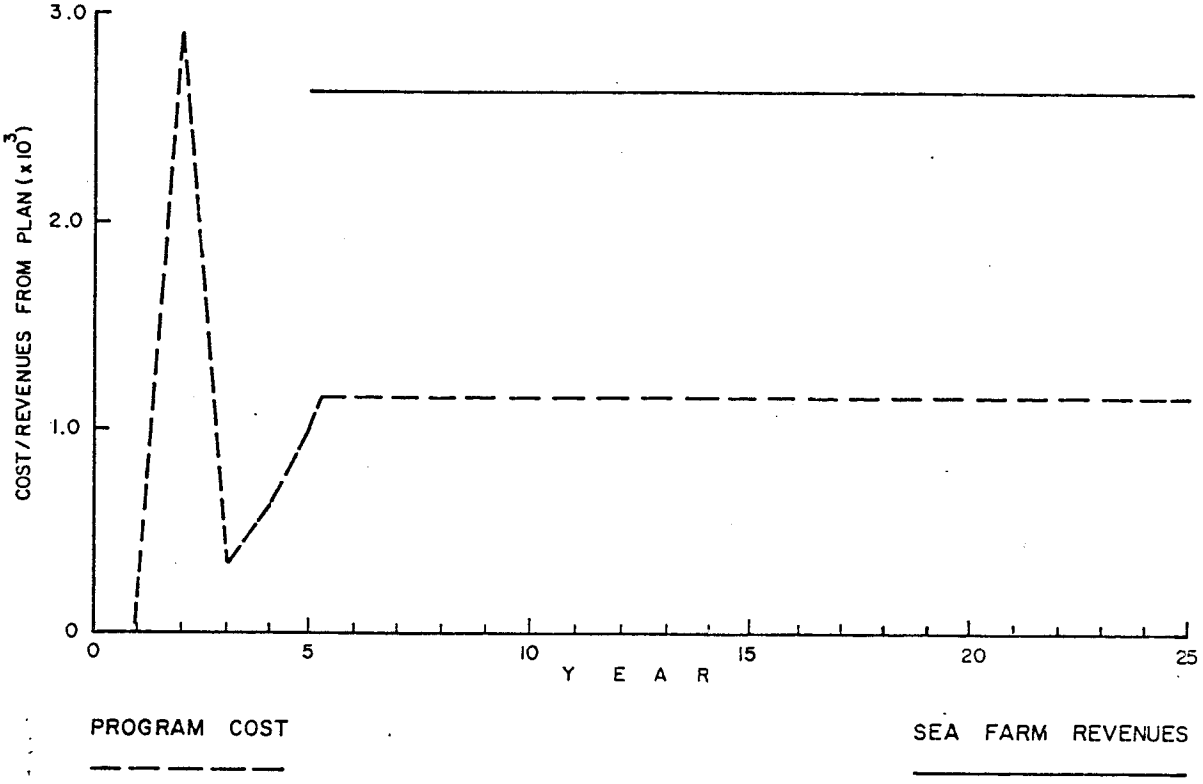

BLACK BROOK ENHANCEMENT PROJECT
COST/REVENUES FROM PLAN (x10^3)
500
400
300
200
100
0
0
5
10
15
20
25
YEAR
SUMMARY
YEAR 1-25
TOTAL PROJECT COSTS ($ 2.63 M)
TOTAL REVENUES ($ 8.44 M)
REVENUES TERMINAL HARVEST ($ 1.54 M)

FIGURE 3.

FISHERY REVENUES & PROGRAM COSTS
AQUACULTURE



APPENDIX B

Summary tables of production, harvest cost and person-year flows for implementing an Atlantic Salmon Enhancement Program of twenty projects under four strategies, Newfoundland-Labrador 1982-2006.

- Production and Harvesting Rationale

Table 1a. Summary table outlining preliminary total annual production and harvest flows from an implemented Salmon Enhancement Program of seven projects in the western Newfoundland portion of the Gulf Region.

Strategy	Year												
	5	6	7	8	9	10	11	12	13-18	19	20-23	24	25
Colonization - Pond Ranching													
Total production (no.)			22,500	32,100	32,100	71,790	88,800	109,300	113,800	125,850	135,300	155,810	164,600
Commercial harvest (kg)			27,792	48,672	48,672	108,230	146,332	177,026	187,106	201,803	222,973	246,589	266,277
Recreational harvest (no.)			1,155	1,565	1,565	5,930	6,270	8,525	8,615	9,941	10,130	12,386	12,562
Public Projects													
Total production (no.)			4,302	6,146	6,146	6,146	6,146	6,146	6,146	6,146	6,146	6,146	6,146
Commercial harvest (kg)			9,926	9,926	9,926	9,926	9,926	9,926	9,926	9,926	9,926	9,926	9,926
Recreational harvest (no.)			485	526	526	526	526	526	526	526	526	526	526
Total													
Total production (no.)			26,802	38,246	38,246	77,936	94,946	115,446	119,946	131,996	141,446	161,956	170,746
Commercial harvest (kg)			32,524	58,598	58,598	118,156	156,258	186,952	197,032	211,729	232,899	256,515	276,203
Recreational harvest			1,640	2,091	2,091	6,456	6,796	9,051	9,141	10,467	10,656	12,912	13,088

Table 1b. Summary table outlining preliminary total annual production and harvest flows from an implemented Salmon Enhancement Program of 13 projects in the Newfoundland Region.

Strategy	Year												
	5	6	7	8	9	10	11	12	13-18	19	20-23	24	25
Colonization - Pond Ranching													
Total production (no.)	22,600	44,600	46,800	81,479	186,340	260,230	283,340	296,700	296,700	319,100	328,700	328,700	328,700
Commercial harvest (kg)	23,200	67,900	69,600	90,782	251,884	422,164	458,378	480,906	480,906	515,560	537,064	537,064	537,064
Recreational harvest (no.)	3,400	6,200	6,800	12,401	20,604	22,532	25,660	27,428	27,428	29,892	30,084	30,084	30,084
Intensive Fish Culture (Provincial)													
Sea Farming													
Total production (no.)	145,407	145,407	145,407	145,407	145,407	145,407	145,407	145,407	145,407	145,407	145,407	145,407	145,407
Commercial harvest (kg)	496,280	496,280	496,280	496,280	496,280	496,280	496,280	496,280	496,280	496,280	496,280	496,280	496,280
River Stocking													
Total production (no.)	18,000	36,000	51,000	51,000	51,000	58,000	121,000	121,000	121,000	121,000	121,000	121,000	121,000
Commercial harvest (kg)	29,330	58,661	83,103	83,103	83,103	94,509	197,167	197,167	197,167	197,167	197,167	197,167	197,167
Recreational harvest (no.)	1,975	3,950	5,596	5,596	5,596	6,364	13,278	13,278	13,278	13,278	13,278	13,278	13,278
Public projects													
Total production (no.)			1,500	1,500	1,500	1,500	1,850	1,850	1,850	1,850	1,850	1,850	1,850
Commercial harvest (kg)			1,760	1,760	1,760	1,760	2,146	2,146	2,146	2,146	2,146	2,146	2,146
Recreational harvest (no.)			168	168	168	168	208	208	208	208	208	208	208
Total													
Total production (no.)	186,007	226,007	244,707	279,386	384,247	465,137	551,597	564,957	564,957	587,357	596,957	596,957	596,957
Commercial harvest (kg)	548,810	622,841	650,743	671,925	833,027	1,014,713	1,153,970	1,176,499	1,176,499	1,211,153	1,232,657	1,232,657	1,232,657
Recreational harvest	5,375	10,150	12,564	18,165	26,368	29,064	39,146	40,914	40,914	43,378	43,570	43,570	43,570

Table 1c. Summary table outlining preliminary total annual production and harvest flows from an implemented Salmon Enhancement Program of 20 projects in the Province of Newfoundland and Labrador.

Strategy	Year												
	5	6	7	8	9	10	11	12	13-18	19	20-23	24	25
Colonization - Pond Ranching													
Total production (no.)	22,600	44,600	69,300	113,579	218,440	332,020	372,140	406,000	410,500	444,950	464,000	484,510	493,300
Commercial harvest (kg)	23,200	67,900	97,392	139,454	300,556	530,394	604,710	657,932	668,012	717,363	760,037	783,653	803,341
Recreational harvest (no.)	3,400	6,200	7,955	13,966	22,169	28,462	31,930	35,953	36,043	39,833	40,214	42,470	42,646
Intensive Fish Culture (Provincial)													
Sea Farming													
Total production (no.)	145,407	145,407	145,407	145,407	145,407	145,407	145,407	145,407	145,407	145,407	145,407	145,407	145,407
Commercial harvest (kg)	496,280	496,280	496,280	496,280	496,280	496,280	496,280	496,280	496,280	496,280	496,280	496,280	496,280
River Stocking													
Total production (no.)	18,000	36,000	51,000	51,000	51,000	58,000	121,000	121,000	121,000	121,000	121,000	121,000	121,000
Commercial harvest (kg)	29,330	58,661	83,103	83,103	83,103	94,509	197,167	197,167	197,167	197,167	197,167	197,167	197,167
Recreational harvest (no.)	1,975	3,950	5,596	5,596	5,596	6,364	13,278	13,278	13,278	13,278	13,278	13,278	13,278
Public projects													
Total production (no.)			5,802	7,646	7,646	7,646	7,996	7,996	7,996	7,996	7,996	7,996	7,996
Commercial harvest (kg)			6,492	11,686	11,686	11,686	12,072	12,072	12,072	12,072	12,072	12,072	12,072
Recreational harvest (no.)			653	694	694	694	734	734	734	734	734	734	734
Total													
Total production (no.)	186,007	226,007	271,509	317,632	422,493	543,073	646,543	680,403	684,903	719,353	738,403	758,913	767,703
Commercial harvest (kg)	548,810	622,841	683,267	730,523	891,625	1,132,869	1,310,229	1,363,451	1,373,531	1,422,882	1,465,556	1,489,172	1,508,860
Recreational harvest	5,375	10,150	14,204	20,256	28,459	35,520	45,942	49,965	50,055	53,845	54,226	56,482	56,658

Table 2a. Summary table outlining preliminary total annual capital operation and person-year costs for implementing an Atlantic salmon enhancement program of seven projects in the western Newfoundland portion of the Gulf Region ($1984).

Strategy	Year											
	1	2	3	4	5	6	7	8	9	10	15	16 ... etc.
Colonization - Pond Ranching												
Person years (no.)	1.7	3.2	3.9	4.7	4.3	6.6	8.5	8.5	7.7	7.5	9.7	9.7
Capital (x $1000)	26.8	605,2	1.3	4.0	1274.9	-	-	-	-	-	536.8	-
O&M (x $1000)	16.1	73.8	87.2	98.2	149.0	136.9	103.3	103.3	103.3	103.3	103.3	103.3
Public projects												
Person years (no.)	9.5	12.2	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4
Capital (x $1000)	90.6	370.3	22.0	-	-	-	-	-	-	-	-	-
O&M (x $1000)	90.8	174.2	133.5	133.5	133.5	133.5	133.5	133.5	133.5	133.5	133.5	133.5
DFO Direction/Administration												
Person years (Permanent no.)	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Capital (x $1000)	29.3	15.3	16.7	10.5	21.4	23.1	27.1	27.1	25.6	24.4	24.4	24.4
O&M (x $1000)	52.2	74.2	63.2	67.1	68.3	73.7	86.9	86.9	82.1	78.1	78.1	78.1
Total DFO Projects												
Person years (no.)	13.9	19.6	15.9	16.5	16.2	18.8	21.4	21.4	20.3	19.9	22.1	22.1
(x $1000)	(292)	(412)	(334)	(347)	(340)	(395)	(449)	(449)	(426)	(418)	(464)	(464)
Capital (x $1000)	146.8	990.8	40.0	14.5	1296.2	23.1	27.1	27.1	25.6	24.4	561.2	24.4
O&M (x $1000)	159.1	322.2	283.9	298.8	350.8	344.0	323.7	323.7	318.9	261.2	261.2	261.2
Total costs	662.1	1815.6	731.4	736.6	2061.8	849.0	898.5	898.5	864.2	795.6	1388.5	851.7

Table 2b. Summary table outlining preliminary total annual capital operation and person-year costs for implementing an Atlantic salmon enhancement program of 13 projects, Newfoundland Region ($1984).

Strategy	Year 1	2	3	4	5	6	7	8	9	10	15	16 ... etc.
Colonization - Pond Ranching												
Person years (no.)	13.9	14.2	19.6	25.7	21.8	24.7	20.1	20.1	21.2	17.7	19.1	19.1
Capital (x $1000)	610.6	73.8	2618.2	1456.1	1677.5	536.8	1006.5	1274.9	-	-	134.2	-
O&M (x $1000)	102.7	230.2	296.0	353.7	345.9	446.3	333.5	333.5	310.7	242.3	253.0	253.0
Intensive Fish Culture (Provincial)												
Sea Farming												
Person years (no.)												
Capital (x $1000)		3355.0	112.2									
O&M (x $1000)		137.9	298.9	841.8	1478.6	1478.6	1478.6	1478.6	1478.6	1478.6	1478.6	1478.6
River Stocking												
Person years (no.)			1.0	1.0	2.5	3.0	3.0	3.0	3.0	9.0	11.5	13.5
Capital (x $1000)	61.0	30.5	103.1	1830.0	732.0	30.5	18.3	18.3	30.5	73.2	24.4	36.6
O&M (x $1000)				144.6	214.1	221.4	221.4	221.4	221.4	439.2	427.0	451.4
Public projects												
Person years (no.)	9.8	10.6	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9
Capital (x $1000)	116.5	8.5	228.1	36.6	36.6	36.6	36.6	36.6	36.6	36.6	36.6	36.6
O&M (x $1000)	78.7	72.0	20.7	20.7	20.7	20.7	20.7	20.7	20.7	20.7	20.7	20.7
DFO Direction/Administration												
Person years												
(Permanent no.)	10.0	10.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
Capital (x $1000)	111.0	39.7	56.5	38.3	76.3	74.5	70.5	70.5	72.0	73.2	73.2	73.2
O&M (x $1000)	197.9	191.8	213.7	245.2	244.0	238.6	225.5	225.5	230.2	234.2	234.2	234.2
Total DFO Projects												
Person years (no.)	34.0	35.6	37.9	44.2	41.7	44.8	39.5	39.5	40.9	43.6	47.5	49.5
(x $1000)	(714)	(747)	(796)	(928)	(876)	(941)	(830)	(830)	(859)	(916)	(998)	(1040)
Capital (x $1000)	899.1	152.5	3006.0	3361.0	2522.5	678.1	1131.9	1400.3	139.1	183.0	268.4	146.4
O&M (x $1000)	488.7	494.0	530.5	764.2	824.8	927.1	801.2	801.2	783.1	988.9	988.7	1013.1
Total costs	2259.0	1557.8	4507.5	5257.3	4415.9	2753.5	2945.7	3214.1	1970.2	2289.5	2474.6	2428.3
Total Sea-Farming Projects												
Person years (no.)												
Capital (x $1000)		3355.0	112.2									
O&M (x $1000)		137.9	298.9	841.8	1478.6	1478.6	1478.6	1478.6	1478.6	1478.6	1478.6	1478.6
Total costs		3492.9	411.1	841.8	1478.6	1478.6	1478.6	1478.6	1478.6	1478.6	1478.6	1478.6
Grand Total - Program												
Person years (no.)	34.0	35.6	37.9	44.2	41.7	44.8	39.5	39.5	40.9	43.6	47.5	49.5
(x $1000)	(714)	(747)	(796)	(928)	(876)	(941)	(830)	(830)	(859)	(916)	(998)	(1040)
Capital (x $1000)	899.1	3507.5	3118.2	3361.0	2522.4	678.1	1131.9	1400.3	139.1	183.0	268.4	146.4
O&M (x $1000)	488.7	631.8	829.4	1606.0	2303.5	2405.7	2279.8	2279.8	2261.8	2467.6	2467.3	2491.7
Total costs	2259.0	5050.7	4918.7	6099.1	5894.6	4232.2	4424.3	4692.7	3448.8	3768.1	3953.3	3906.9

Table 2c. Summary table outlining preliminary total annual capital operation and person-year costs for implementing an Atlantic salmon enhancement program of 20 projects, Newfoundland and Labrador 1982-2006 ($1984).

Strategy	Year											
	1	2	3	4	5	6	7	8	9	10	15	16 ... etc.
Colonization - Pond Ranching												
Person years (no.)	15.6	17.4	23.5	30.4	26.1	31.3	28.6	28.6	28.9	25.2	28.8	28.8
Capital (x $1000)	637.5	679.1	2619.6	1460.1	2952.4	536.8	1006.5	1274.9	-	-	671.0	-
O&M (x $1000)	228.3	304.0	383.2	451.9	495.0	583.2	436.9	436.9	414.1	345.6	356.4	356.4
Intensive Fish Culture (Provincial)												
Sea Farming												
Person years (no.)												
Capital (x $1000)		3355.0	112.2									
O&M (x $1000)		137.9	298.9	841.8	1478.6	1478.6	1478.6	1478.6	1478.6	1478.6	1478.6	1478.6
River Stocking												
Person years (no.)			1.0	1.0	2.5	3.0	3.0	3.0	3.0	9.0	11.5	13.5
Capital (x $1000)	61.0	30.5	103.1	1830.0	732.0	30.5	18.3	18.3	30.5	73.2	24.4	36.6
O&M (x $1000)				144.6	214.7	221.4	221.4	221.4	221.4	439.2	427.0	451.4
Public projects												
Person years (no.)	19.3	22.8	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3
Capital (x $1000)	207.2	378.8	250.1	36.6	36.6	36.6	36.6	36.6	36.6	36.6	36.6	36.6
O&M (x $1000)	169.5	246.2	154.2	154.2	154.2	154.2	154.2	154.2	154.2	154.2	154.2	154.2
DFO Direction/Administration												
Person years												
(Permanent no.)	13.0	15.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0
Capital (x $1000)	140.3	54.9	73.2	48.8	97.6	97.6	97.6	97.6	97.6	97.6	97.6	97.6
O&M (x $1000)	250.1	266.0	276.9	312.3	312.3	312.3	312.3	312.3	312.3	312.3	312.3	312.3
Total DFO Projects												
Person years (no.)	47.9	55.2	53.8	60.7	57.9	63.6	60.9	60.9	61.2	63.5	69.6	71.6
(x $1000)	(1006)	(1159)	(1130)	(1275)	(1216)	(1336)	(1279)	(1279)	(1285)	(1333)	(1462)	(1504)
Capital (x $1000)	1045.9	1143.3	3046.0	3375.5	3818.6	701.5	1159.0	1427.4				
O&M (x $1000)	647.8	816.2	814.4	1063.0	1175.6	1271.1	1124.8	1124.8	1102.0	1251.3	1249.9	1274.3
Total costs	2920.9	3373.4	5238.9	5994.0	6477.7	3602.5	3844.2	4112.6	2834.4	3085.0	3863.1	3280.0
Total Sea-Farming Projects												
Person years (no.)												
Capital (x $1000)		3355.0	112.2									
O&M (x $1000)		137.9	298.9	841.8	1478.6	1478.6	1478.6	1478.6	1478.6	1478.6	1478.6	1478.6
Total costs		3492.9	411.1	841.8	1478.6	1478.6	1478.6	1478.6	1478.6	1478.6	1478.6	1478.6
Grand Total - Program												
Person years (no.)	47.9	55.2	53.8	60.7	57.9	63.6	60.9	60.9	61.2	63.5	69.6	71.6
(x $1000)	(1006)	(1159)	(1130)	(1275)	(1216)	(1336)	(1279)	(1279)	(1285)	(1333)	(1462)	(1504)
Capital (x $1000)	1045.9	4498.2	3158.2	3375.5	3818.6	701.5	1159.0	1427.4	164.7	207.4	829.6	170.8
O&M (x $1000)	647.8	954.0	1113.3	1904.8	2654.2	2749.8	2603.5	2603.5	2580.7	2730.0	2728.5	2752.9
Total costs	2920.9	6866.3	5650.1	6835.8	7956.4	5081.2	5322.9	5591.3	4313.1	4563.7	5341.8	4758.6

Production and Harvesting Rationale

Throughout this document production and harvesting estimates (and hence, benefits) of twenty individual projects are presented. These figures represent estimates based on a series of assumptions, established parameters and results from specific investigations. Much of the data were extracted from the Biological Conservation Subcommittee Report prepared for the 1978 Atlantic Salmon Review Task Force.

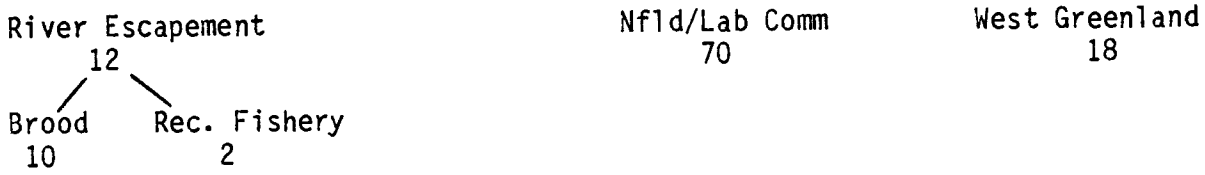
The amount of stream rearing habitat forms the basis of production estimates for colonization projects. Such habitat is generally quantified into rearing units (100 m^2 of rearing area) and production is estimated to be 3 smolts per unit. Estimates from pond ranching proposals are based on a production of 100 smolts per hectare of standing water. Throughout the document a figure of 15 percent is used as an estimate of sea survival from the smolt to adult stage (before exploitation).

The large salmon:grilse ratio used in the various project production estimates reflects past research into the stock composition of various rivers or, in some cases, are extrapolated from data collected from adjacent rivers or commercial fishery catches. For example, a combination of commercial and recreational fishery sampling, and fishway counts indicate a 30:70 large salmon:grilse ratio for the Exploits River; information from the commercial and recreational fisheries in northern Labrador has resulted in an estimated production ratio of 60:40 large salmon:grilse for Canairiktok River. Past investigations have shown that production of large salmon in Avalon peninsula rivers is very low and, in this document, production in the Avalon rivers is estimated to be 100% grilse. Weights of adult fish are derived similarly and production tables for Exploits River use the following weights: river escapement-grilse 1.5 kg, large salmon 3.2 kg; commercial fishery-grilse 2.0 kg, large salmon 3.2 kg. For northern Labrador the following weights were used: river escapement-grilse 1.7 kg, large salmon 4.3 kg; commerical fishery-grilse 2.0 kg, large salmon 4.3 kg. Sex ratios derived for Exploits River were 75:25 F:M for grilse and 85:15 F:M for large salmon. For Canairiktok River sex ratios of 20:80 F:M for grilse and 80:20 F:M for large salmon were used. Fecundities of 1540 eggs/kg were used throughout the production tables.

Utilization of salmon production was standard for most project proposals in insular Newfoundland; again, Labrador values varied due to differential exploitation. The following illustrates the assumed harvest of various stocks:

Insular Newfoundland

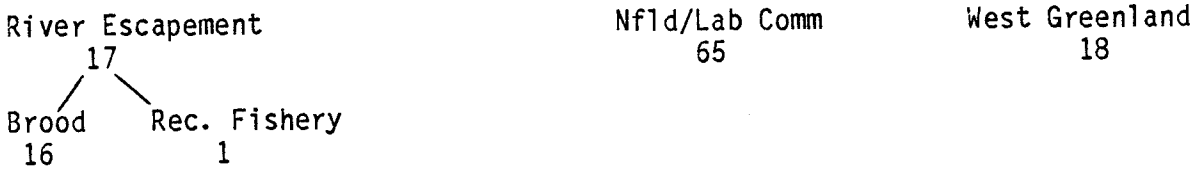
Utilization of Large Salmon Production (%) except Avalon Rivers.



Utilization of Grilse Production (%) including Avalon rivers.

Labrador

Utilization of Large Salmon Production (%)



Utilization of Grilse Production (%)

Harvest in the commercial fishery is broken down into Statistical Area (see attached maps). These estimates were derived from past tagging studies and commercial fishery sampling which provided information on migration routes and timing, fishing patterns etc. Estuarial harvest represents the additional river escapement resulting from a fishing plan to reduce interception of non-Newfoundland/Labrador salmon by 25%. This escapement would be over and above recreational fishery and brood requirements and would be available for harvest.

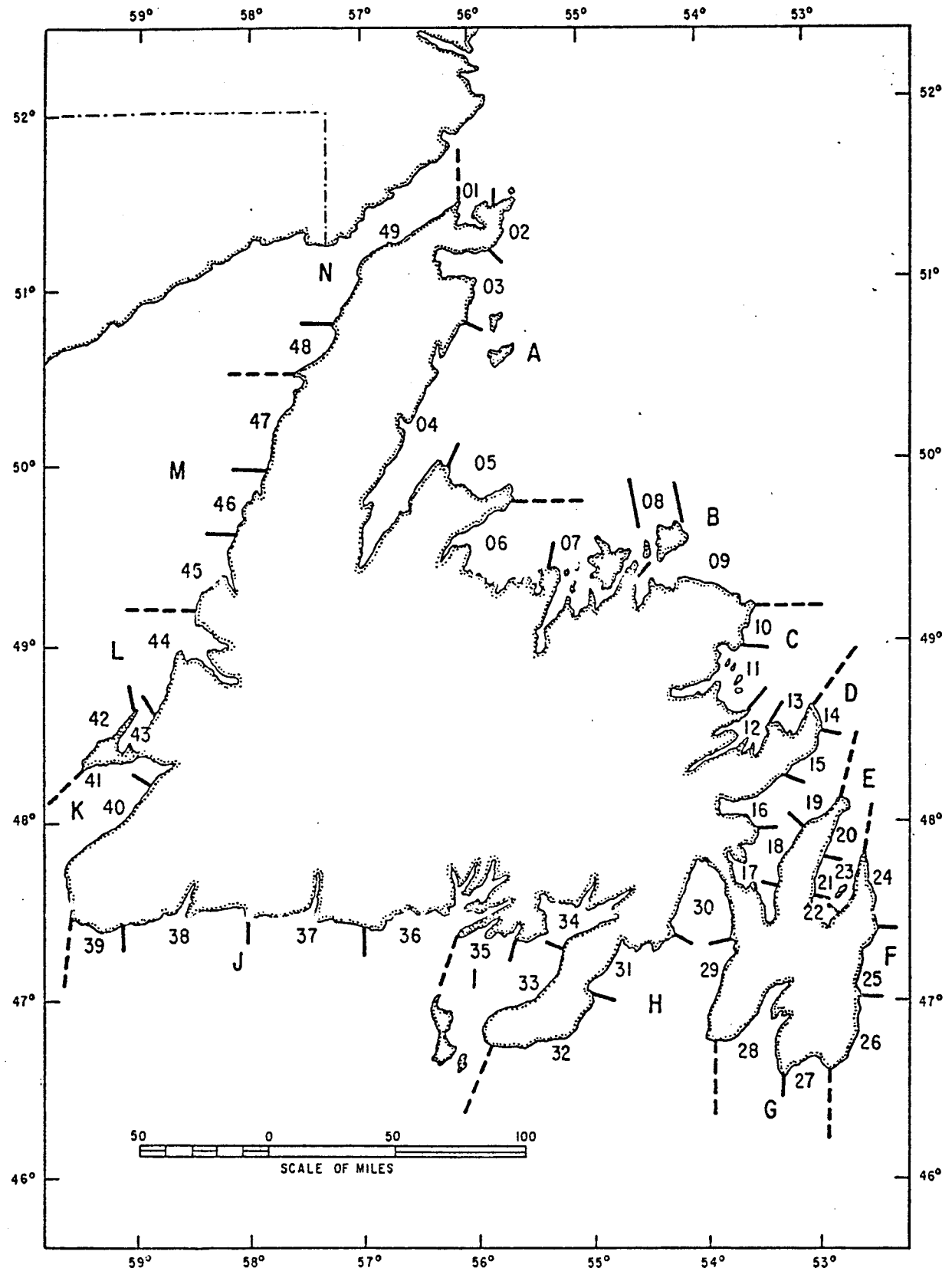


Fig. 1. Boundaries of Statistical Section (numerically indicated) and Statistical Areas (alphabetical) in insular Newfoundland.

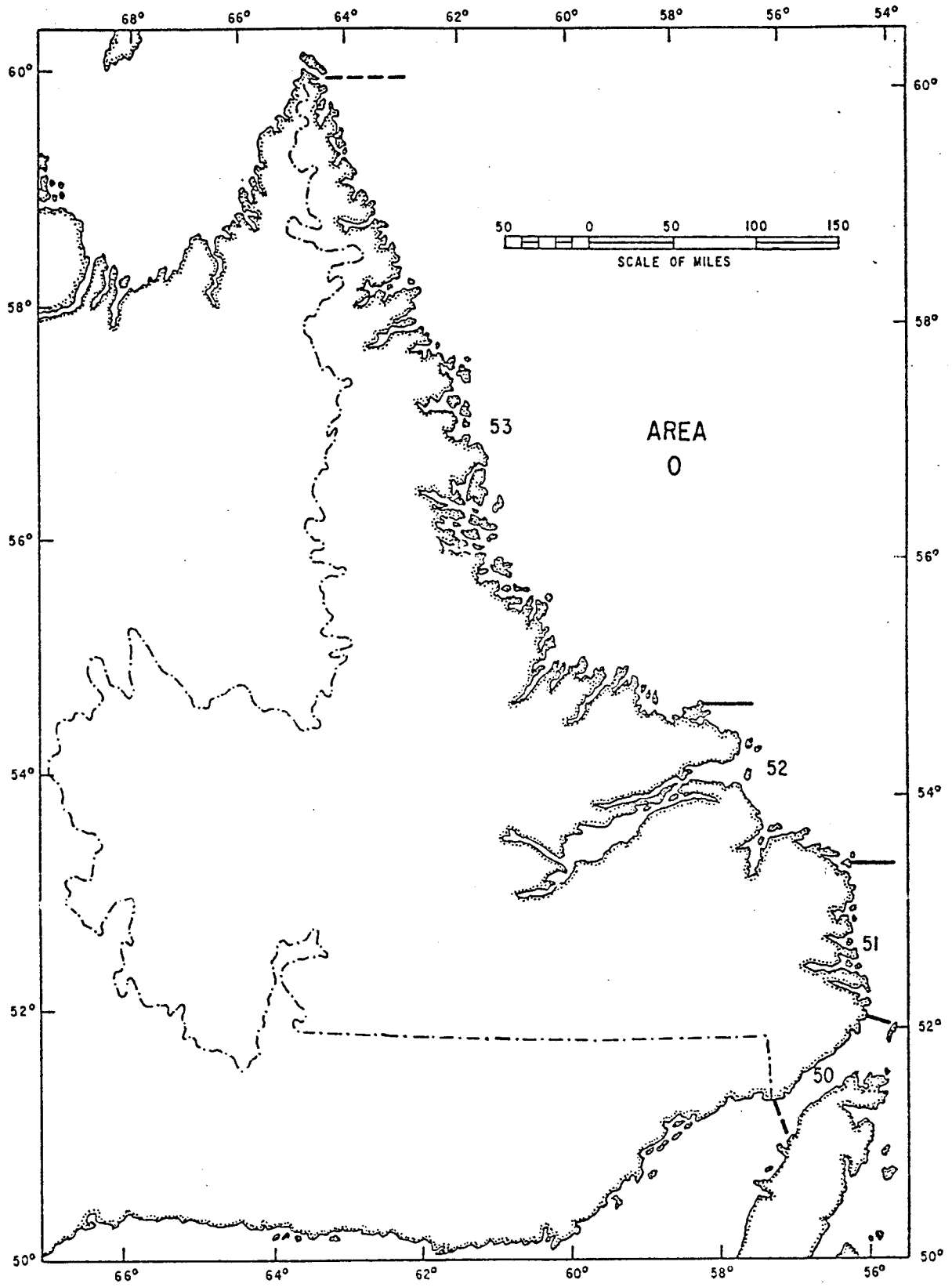


Fig. 2. Boundaries of Statistical Section (numerically indicated) and Statistical Areas (alphabetical) in Labrador.

APPENDIX C

Descriptions of Enhancement Projects Activity, production costs and person-year flows, colonization and pond ranching strategies.

(a) Colonization Projects

- Exploits River
- Humber River
- Terra Nova River
- Canairiktok River

interests, several of the associations have already prepared and submitted enhancement project proposals to be implemented under their sponsorship. (For proposal details, see Appendix D-b.) Hence, the participation of the development associations is believed to be a key step towards effective community involvement in enhancement.

Conservation associations, rod and gun clubs and other volunteer organizations are being encouraged to become involved in small stream projects oriented to activities that inform and educate on the resource and its government-related programs. Just as important, such activities will provide major contributions to restoring, maintaining or improving salmonid habitat and the fish populations. About fifteen Fishery and Wildlife Conservation Associations offer a potential as project sponsors, together with numerous other public service groups such as Rotary, Kinsmen, etc.

As part of the public education thrust, students in school science courses would be subjected to a special enriched curriculum focused on the salmon resource. The object would be to instill an early awareness to the role of salmonids in the ecosystem and the mutual dependence of man and the resource.

To ensure effectiveness of communities in developing and operating projects, DFO would sponsor a public involvement unit responsible for ensuring the technical and administrative integrity of public projects. This will require special technical and educational coordinators who would advise on project management/operations and provide or guide on-job, workshop and institutional training programs.

As part of the planning phase for the undertaking, during 1981, the DFO Area Offices sponsored six planning meetings within Newfoundland-Labrador in order to ascertain interest of community and public groups in sponsoring and conducting their own enhancement projects. More than 25 rural development associations, and several rod and gun conservation groups have participated.

(2) Additional major benefits of the enhancement

The social and economic well being of Newfoundland residents will be improved by creation of employment opportunities during the construction phase plus the new jobs generated thereafter by ongoing projects. Significant spinoff benefits to tourism and other commercial industries will result from the program. Such benefits however will be difficult to quantify.

Education, training, public relations and information exchange components built into the venture will create a better awareness of conservation practices among Newfoundland residents and enhance the image of Governments.

Technological and biological advances from the research and development phase of the program will result in new and improved approaches to fisheries management and enhancement.

The aesthetic value and attraction created by flourishing stocks of salmonids, in Newfoundland streams, cannot be measured in comparison to their value as fishless streams. The presence of salmonids in these streams is a symbol of environmental cleanliness, of concern for preserving environmental quality and, in general, a measure of the nation's well-being.

D. Government Cooperation and Coordination

The British North America Act assigns exclusive responsibility for all "sea coast and inland fisheries" to the federal government. The Federal Fisheries Act and regulations made thereunder, to protect fish habitat and control harvesting, bear on the exploitation of provincially-administered natural resources such as water, timber, and minerals. Salmonids are a common property resource belonging to the people of Canada and only the federal government can make the investment in river enhancement and distribute the benefits accruing to the public sector. However, salmon enhancement could have significant consequences for certain areas of provincial responsibility since commitment of freshwater systems, to full salmon production, might affect alternative uses of the watersheds. Hence there is a need for federal-provincial negotiation and cooperation, during enhancement planning.

In order to accommodate the increased fishery harvest, consultations will also be necessary, between the two governments, in respect to special fishery licensing systems geared to river mouth harvesting principles; negotiations relating to processing capacity plus quality, and diversity of fish products for domestic and international marketing.

There is considerable interest on the part of the Federal and Provincial governments to cooperate and support the planning and implementation of a salmon development initiative. This has been demonstrated by the willingness of various agencies to participate in the membership of Core and Technical Planning Committees during 1980/81. A draft federal-provincial Memorandum of Understanding, towards planning an extensive enhancement proposal, has been jointly developed for ratification by the Ministers responsible. More formalized arrangements, covering cooperation between the two governments, will be developed when it is decided to implement the plan.

Due to far reaching positive social and economic impacts of the proposed Atlantic salmonid development undertaking, with respect to stimulating national wealth, employment, regional development and native and environmental well being, interdepartmental liaison has been established between DFO and the other federal and provincial agencies with interests and jurisdictions in these areas. Such liaison through membership on the planning committees ensures that socio-economic policies/goals, of all agencies involved, are properly addressed and that interdepartmental cooperation and funding support for enhancement is maximized.

The federal departments of CEIC (i.e. employment) and DRIE (regional development) are represented on the Newfoundland planning committees with DOE (i.e. environment) and DINA (i.e. native peoples) being consulted as required. A further six provincial agencies are also represented or consulted such as

those responsible for environment, rural or northern development, education, intergovernmental affairs and aquaculture. The Provincial Department of Environment, in close cooperation with Habitat Protection (DFO), the Federal Environmental Protection Service, and Newfoundland-Labrador Hydro review proposed enhancement planning with respect to long-term water usage, stream alterations; they also ensure appropriate registrations or referrals. Thus far consultations indicate very few areas of conflict concerning potential hydropower - salmon developments within watersheds with a willingness of the agencies to cooperate in protecting and enhancing natural resources and habitat. The Department of Rural Agricultural and Northern Development is providing technical support and coordination for DFO public enhancement projects at the community level through 49 Development Associations as well as supporting provincial aquaculture ventures. The Department of Education is reviewing the possible use of salmon enhancement program materials in the school science curriculum and providing liaison with the Newfoundland Teachers Association as required. The Parks and Wildlife Division, Department of Culture Recreation and Youth, is also cooperating in developing salmonid enhancement education programs for parks in the province. The Division has also expressed interest in the establishment of appropriate enhancement projects within the provincial parks.

Within Newfoundland, there has been a growing awareness of the potential of a fish farming industry for salmon both within public and private sector fisheries. This has resulted in both federal and provincial fisheries agencies being drawn into aquaculture proposals on behalf of their respective clients. While meaningful planning discussions continue concerning the potential of this emerging industry, the development of further cooperative arrangements are required between the governments. The priority areas include: review of legislative mandates governing the issue of aquaculture permits; the establishment of a provincial planning board and extension services; the conduct of research-pilot investigations; where applicable, the planning of common hatchery facilities to support research and production needs of each government; and the precise responsibilities for, and agreements on, funding (Appendix E-a)

III. DESCRIPTION OF THE PROPOSED SALMON DEVELOPMENT PROGRAM

A. Introduction

The salmon development proposal, to substantially increase fishery benefits within Newfoundland waters, is opportune considering major problems with respect to implementing the recommended management plan of fishery restrictions. In fact, its inclusion would represent one of the few positive elements that the plan could potentially offer. In the case of Atlantic salmon, various measures in addition to development, are being explored and reviewed as remedies to fishery shortfalls expected from interceptions and licencing reduction formulae. Among these measures are fishermen gear buy-back and annual compensation. Integration of enhancement into potential solutions would increase flexibility and popularity of the new salmon plan in dealing with geographic, temporal, technical and production dimensions of this widespread coastal dilemma. Even the implementation of the partially developed

enhancement plan containing 20 projects without the other remedial measures would contribute significantly toward reversing negative impacts of interceptions reduction in south and north east coastal fishing areas. Certain Avalon commercial salmon fisheries would require more intensive, costly development approaches to dampen the socio-economic impacts of this fishing plan. However, these Avalon commercial fisheries are not significant from a community dependence point of view and occur in areas where salmon recreational fisheries appear more appropriate.

Rehabilitative advantages of resource development for the commercial fishery should not overshadow its most important potential role: namely that of eventually improving yield, quality and stability in practically all marine and freshwater salmonid fisheries throughout the province. Such an enhancement program would provide the option of more flexible licencing, extended distribution of catch and expanded revenue.

B. Schedule, Sequence and Process for Developing River Enhancement Strategy and Project Options

A combination of cost-effective resource development strategies, based on bio-engineering technology, would be applied over a ten-year period. Phase I would allow optimization of harvest/management principles for the existing fisheries and laying of the management foundation required for further harvest utilization of the newly enhanced fishery benefits, first expected in Phase II. The approach would be one of implementing a mix of low, intermediate, and high technology strategies assessed technically and economically feasible. These would be gradually blended with new strategies which eventually demonstrate feasibility through continuing research and piloting.

Enhancement strategies and projects have been identified and refined by the Federal-Provincial Technical Working Group (TWG). In addition to ascertaining biological and engineering feasibilities, projects were subjected to modelling exercises with respect to production potential, management, and harvesting regimes. A computer model identified the "top 50" candidate watersheds as an inventory for major enhancement considerations. Strategy/project options were then developed along with basic cost production flows for the reconnaissance through to post-evaluation stages. The most desirable enhancement/management options proposed for the priorized watersheds were next subjected to a general socio-economic framework of criteria modelled after that used in development of the Pacific Salmonid Enhancement Program and which was found acceptable to National Treasury Board. The "five account" evaluation framework was adapted to examine potential enhancement impacts relating mainly to national income generation but also to employment, regional development and native/environment well being (Appendix G-a). Benefit:cost analysis was conducted on the series of most appropriate enhancement options. Following analyses by the TWG; the proposals were then submitted to the Federal-Provincial Core Working Group for their consideration and feedback, especially in relation to: production targets and scale, timing and geographic distribution of enhancement effort, and to options favoured.

Projects developed by community and public groups were subjected to the Enhancement Planning Groups and the above-described production, bio-engineering

and socioeconomic criteria while assembling the public involvement component of the development plan. Invariably, major projects submitted that focused on long-term economic salmon production fell within the list of 50 potential watersheds, while projects emphasizing public education and environmental preservation were usually located on smaller salmon streams not included in the potential enhancement inventory.

Broader comparative benefit: cost analysis were then prepared for two basic scenarios in relation to the emerging management plan:

i. Enhancement without any change in management (based on the 1980 "status quo").

ii. Enhancement within the new improved "best use" management incorporating the fishery harvest restrictions discussed (i.e. a 25% reduced interception on non-Newfoundland fish within commercial fishery).

C. Current Status of Project Planning

Twelve major river enhancement projects have been identified and are being refined as the focus of projects with a ten year program. DFO Planning Groups have now reviewed an additional seven small stream improvement proposals in cooperation with the Provincial Rural Development, Conservation or Rod and Gun Club Associations. Collectively, the potential mix of projects, identified to date, meet the economic criteria for public investment in terms of favourable benefit-cost ratios and in terms of other social indicators such as employment, regional development, or environmental quality. Although there is a need to further refine the costs of conservation-protection of the enhanced stocks, it is predicted that any added costs will not be prohibitive to the overall program.

The lack of an operational market for salmon angling in Newfoundland complicates economic impact analysis with respect to the value of angling fishery benefits arising from enhancement. However, conservative assumptions, placing the value of recreationally caught fish at twice that of the commercial landed value results in calculation of very favourable benefit to cost ratios for the ten major projects under consideration. (For further details, see Appendix G-b.)

D. Technical Rationale and Background to Major Salmon Development Strategies

Canada has consistently undertaken research and development programs to develop, expand and apply new technology to increase Atlantic salmonid stocks in the four Atlantic provinces. The methodology, for providing fish passage for Atlantic salmonid runs, has improved and various specialized stocking techniques are available to meet environmental constraints. Provided appropriate brood sources are available, this methodology will supply an effective means for operating within unutilized habitat, thereby realizing production benefits that would otherwise remain untapped.

Enhancement activities in the Newfoundland Region have concentrated on increasing salmon production in underutilized or barren sections of rivers. Basically, three techniques have developed steadily over the past twenty-five years. All of these techniques have gone through the experimental, pilot and production scale phases successfully and therefore represent a proven technology upon which initial strategies of a program may be based. Stream remedial, adult transfers, spawning channels and swim-up fry incubators are the principal components that have evolved to support the enhancement initiative.

Stream remedial refers to improvements in fish passage at natural and man-made obstructions for juvenile and adult forms of salmonids. It includes a wide assortment of measures: blasting to reduce gradients of natural waterfalls or rapids; removal of dams, creation of channels and resting pools for migrants; and construction of fishways. These measures have improved fish passage reducing migration delays, stress and threats of poaching upon resident salmon runs. In many cases additional spawning has been provided to underseeded areas. Stream clearance activities have been successful on 25 to 30 streams, thereby stabilizing or gradually increasing the size of the escapements. It is estimated that Atlantic salmon production in the Newfoundland Region could be increased another 10 percent through such inexpensive minor remedial work at partial obstructions that impede salmon migration. Of eight fishways built to overcome serious or total obstructions in extensive river systems, only one has failed. Marked increases in salmon runs have been attributed to fishway construction on an additional five major watersheds on the Island.

Although such stream remedial methodologies have proven successful, monitoring of salmon escapements at fishways indicates that relying on strays to populate upstream salmonid waters is a slow process. However, complementing fishway construction by stocking of newly opened areas with juveniles or adults has greatly accelerated establishment of anadromous runs. Such enhancement, which results in the development of self-sustaining populations in areas currently inaccessible to salmon migration or accessible but devoid of salmon, is often referred to as "colonization". On the Exploits and Torrent rivers construction of three fishways, combined with stocking activities, now accounts for total annual runs exceeding 35,000 adults or roughly 5 percent of the provincial resource base.

While not fully developed, the $4 million Exploits River Project has yielded results which suggest that it will be cost effective. Project benefits are now higher than first anticipated at the project's inception. Recent performance has resulted in the recommendation by British Columbia biologists that Pacific Salmonid Enhancement funding be invested within similar colonization strategies to develop steelhead trout runs within British Columbia rivers.

Adult transfers and swim-up fry stocking techniques employed within the colonization ventures have accounted for the rapid consolidation of Atlantic salmon runs within ten major Island streams. The technique of adult transplants has proven cost-effective for enhancing populations given an adequate brood stock source; such was the case with the successful Torrent and Great Ratting Brook transfers.

Unfed salmon fry distributions have been demonstrated to make efficient use of brood fish at acceptable costs within the watersheds seeded. Spawning channels and incubation boxes, utilizing gravel and artificial turf incubation media, have been proven as effective production options for cost effective salmon enhancement opportunities. However, lower capital, operating, and maintenance costs, together with a greater flexibility of production scales, make incubation box technology the most desirable alternative under most stocking circumstances. For example, current testing and refinements of modular recirculation units look promising for application within community enhancement projects.

Recent promising experiments at Indian Brook, Halls Bay are indicating the potential for significant increases in salmon production through the use of standing waters for juvenile salmon rearing. Further research and piloting is proceeding for two years to perfect the fry stocking technique prior to initiating production-scale enhancement projects. The first acceptable rate of adult return to the experiment was acquired within the fisheries and river escapement during 1980. It is planned to have this methodology ready for widespread project implementation within three years.

There are a number of new and promising techniques, such as semi-wild rearing, stream habitat improvement and lake or stream enrichment, that still require varying degrees of research prior to pilot application. Semi-wild rearing investigations are underway with the first encouraging early fry feeding experiments conducted during 1981. Research into feeding has since been extended to fingerling rearing within modified spawning channel pool impoundments and within net cages placed in lakes. Stream habitat alterations, including the assessment of boulder and log/gabion formations within stream beds, together with baseline research towards water fertilization, will be evaluated in future.

There are no government hatcheries in the Province of Newfoundland. Several bio-engineering surveys have been conducted towards locating a multipurpose facility to provide a much-needed enhancement capability and versatility in support of intensive common property salmon fisheries. Of five potential sites, Bay D'Espoir located on the south coast of insular Newfoundland, is currently considered to have the best hatchery potential for both diverse and cost-effective strategies.

Hatcheries have been used within the Maritime provinces, Quebec and New England states since the late 1800's. Nonetheless, it is only in the last ten years that demonstrable success has been achieved towards cost-effectiveness. For example, in the Maritimes Region, substantial progress has been achieved in hatchery technology as a means of supporting salmon production. This has resulted from extensive testing, monitoring and evaluation exercises in the area of nutrition, disease control, water quality and in relation to the location, timing, size and stock origin of hatchery fish released. Many hatcheries have a reproductive rate from egg to smolt of approximately 20 times that estimated for salmon reared in the natural freshwater environment. However, until recently, smolt rearing costs remained prohibitive since survival of hatchery smolts, once released, remained significantly lower than their wild counterparts. With recent research

advances, smolt to adult survival rates in modern plants now approximate one half natural rates for rapidly growing one-year smolt. This production scheme has now virtually replaced the regular two-year hatchery product. Younger smolts for stocking within streams unsuitable for colonization because of habitat deterioration or low productive capacity can be reared at substantially lower costs. Release of hatchery reared fingerlings has also shown promise and is suggesting efficient enhancement plans for colonization/restoration of large watersheds. This technique has the potential to yield 2- or 3-fold increases in smolt survivals when compared to unfed-fry to smolt survivals.

In Newfoundland, the higher technology hatchery envisioned would be designed to utilize surface, ground and heated water supplies in the rearing of fed products such as fingerlings and one-year smolts. In this respect, the unique potential of the Bay D'Espoir location would be advantageous since a production-scale souce of waste heat could be tapped from an adjacent hydro-power plant as well as quality ground water supply from site aquefers.

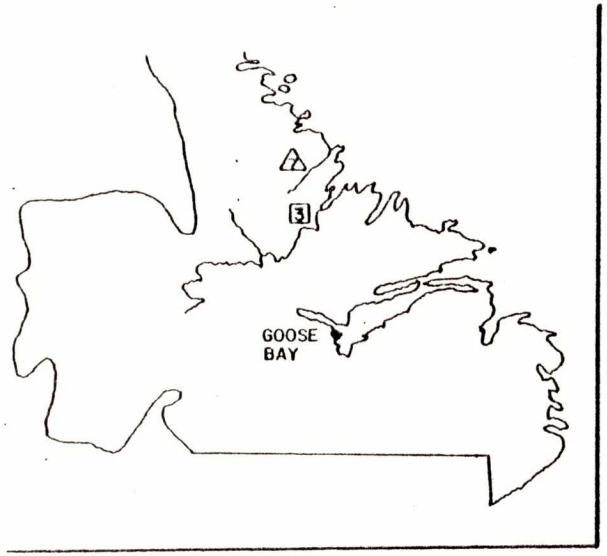
E. Development Strategies

Five main strategies ranging from the simple romoval of debris at small physical migration obstructions through to more complex artifical propagation of salmon within hatcheries and the sea will be used to develop salmon production within the Newfoundland Region. Concentrating initially on this proven technology, ongoing research and pilot projects will refine or evolve new technologies aimed at increasing both the rate and magnitude of salmon production, thereby continuously improving cost-effectiveness while dramatically improving catches within the net and angling fisheries.

(1) Colonization

Having perfected technologies of swim-up fry production and distribution, stream obstruction removal and adult transfer, the strategy of river colonization will be the major initial thrust of the new enhancement initiative. Colonization projects are to be initiated on the Terra Nova, Humber and Canairiktok (Labrador) rivers (Fig. 1) provided certain baseline-feasibility investigations are completed beforehand. Annual test-monitor stocking of Lloyds River, a tributary of the Upper Exploits River (Fig. 1) was begun in 1981. If the Lloyds stocking and fish passage investigations at Red Indian Dam, central Exploits River prove feasible, then production scale stocking of an additional five major headwater tributaries will start in 1984. Fry stockings from swim-up fry incubators will be the stocking technique employed on the Exploits and Canairiktok Rivers while adult transfer stockings will be used for the Humber and Terra Nova Rivers.

Annual production potential of Atlantic salmon colonization projects proposed for Phase I of the Enhancement Program is estimated to be 129,000 adults (320 t) that would be available to fisheries and escapements. The projects have an acceptable mix of Benefit:Cost ratios, even following additional costings for new river-mouth or terminal fishing regimes associated with the new managment plan advocating interceptions reduction within commercial fisheries. Commercial fisheries could harvest up to 74,000 adults



□-COLONIZATION PROJECTS
1. EXPLOITS R.
2. TERRA NOVA R.
3. CANAIRIKTOK (LAB.)
4. HUMBER R.

○-POND RANCHING PROJECTS
1. BLACK BROOK
2. ROBINSONS R.
3. INDIAN BAY BROOK
4. GANDER BAY BROOK
5. TORRENT R.
6. SOUTH BROOK

△-PUBLIC INVOLVEMENT PROJECTS
1. SALMON COVE, (C.B.)
2. SALMON COVE, (T.B.)
3. HICKMANS HARBOUR
4. PORTLAND CREEK, (G.N.P.)
5. DEER LAKE
6. ROMAINES RIVER
7. HUNT RIVER, (LAB.)

◆-BAY D'ESPOIR HATCHERY
◇-SATELLITE RIVERS
1. DOLLARD R.
2. GREY R.
3. WHITE BEAR R.
4. LA POILE R.

ST. ANTHONY
CORNER BROOK
GANDER
ST. JOHN'S

P-16

Fig. 1. Location of 21 salmon enhancement projects in Newfoundland and Labrador.

(203 t). Recreational fisheries harvest could increase by 9500 adults (20 t) within expanded river fisheries.

For details of activity and cost flows, benefit:cost analyses and production and harvest allocation on a project by project basis, see Appendix C-a.

(2) Pond ranching

Considering the favourable progress of previous experimentation with the near proven pond ranching strategy (i.e. the planting of swim-up fry for increased salmon smolt production in selected standing water areas on a continuing basis), a pilot project was implemented at Black Brook (a tributary of Indian Brook), Halls Bay (Fig. 1) during 1982. The assessment has continued towards perfecting the technique at various production scales. A swim-up fry incubation box facility constructed in 1983, 1984 provides 2.2 million fry for stock out to extensive pond areas within the Black Brook system. A small part of the facility production would also support future fry pen rearing experiments within selected standing water and stream habitats.

Following those strategy refinements, five major projects would then be brought on stream. Preliminary bio-engineering and socio-economic feasibility investigations locate initial incubation facilities in Western, Northern and Central areas of the island: Robinsons River, Torrent River, South Brook, Gander Bay Brook, and Indian Bay Brook (Fig. 1). Besides stocking the watersheds indicated, the facilities would provide satellite stocking for an additional 11 watersheds, namely Crabbes River, Highlands River, Fischells River, Flat Bay River, East River, River of Ponds, Little Brook Ponds, Cloud River, Northwest Brook, Castors River, and Ragged Harbour rivers (Fig. 1). Potential exists for the refinement of at least an additional five such projects in South Coast and Avalon Peninsula areas.

Although pond ranching projects are ranked second in priority due to the necessity to fully prove up the technology, the strategy offers by far the largest production potential for the two phase enhancement program. For the five projects identified, the estimated production is 320,800 adult salmon (787 t) which could provide an annual yield of 216,000 adults (513 t) to the provinces commercial fishermen and 33,000 fish (53 t) for the sports angler. Compared to colonization, the project benefit: cost ratios for pond ranching are even more favorable. This is attributable to the higher harvesting rates, reduced start-up periods prior to realizing fishery benefits and the lack of a requirement to provide expensive fish passage facilities. Such projects are especially amenable to terminal harvest regimes which could crop increased run surplus at the project facility in the event that commercial fishery interceptions reduction measures are incorporated into the management plan. For details of activity and cost flows, benefit: cost analyses and production/harvest allocation on a project by project basis, see Appendix C-a and G-b.

Combined Cost/Labour and Production for Ten Colonization and Pond Ranching Projects:

Year:	1	2	3	4	5	...	11	...	24
New Costs ($000, 1981)	1,037	1,171	2,955	2,206	3,374		812		897

Year:	1	2	3	4	5	...	11	...	24
New Total Production ('000 pcs)	67	94	219	334	374		413		496

Total capital and operating cost (including labour requirements) for the mix of 10 colonization and pond ranching projects combined in terms of 1981 dollars are summarized above. Details of cost, production and harvest allocation for the 10 projects are presented in Appendix C. These data are also summarized graphically in Fig. 2.

(3) Intensive fish culture

The Core Planning Group proposes that a joint hatchery venture be considered by the provincial Department of Fisheries and DFO with funding and construction on a phased basis. As consultations proceed, it appears that DFO responsibilities within a hatchery at Bay D'Espoir would relate to development of common property fisheries plus research support towards improvement of resource development methodologies as applied to both common property fishery and private sea farming ventures.

Although intensive seapen culture is greatly constrained in Newfoundland by lethal winter surface water temperatures in most coastal areas, provincial agencies are confident that private salmonid aquaculture will eventually prove economic pending cage culture tests and piloting in sheltered south coast environs of Bay D'Espoir. A Bay D'Espoir Aquaculture Feasibility Report (1980) recommends consideration of 200,000 smolts for pen rearing pursuits on the basis of economic and employment benefits (i.e. projected production = 400,000 kg of salmon with longterm employment involving 35 jobs).

During the first two years of the 10-year development plan, the provincial government would coordinate and participate in construction of a modular type plant which in the first phase would serve the emerging aquaculture industry. DFO would subsequently initiate and finance the second phase through the new salmon development program.

DFO interests in a multipurpose hatchery at Bay D'Espoir would focus primarily on enhancement of public fisheries. The use of waste heat, produced within an adjacent hydro-power generating plant for acceleration of early growth of fish, is a feature that significantly improves the project's economic viability as well as the potential diversity of salmonid products.

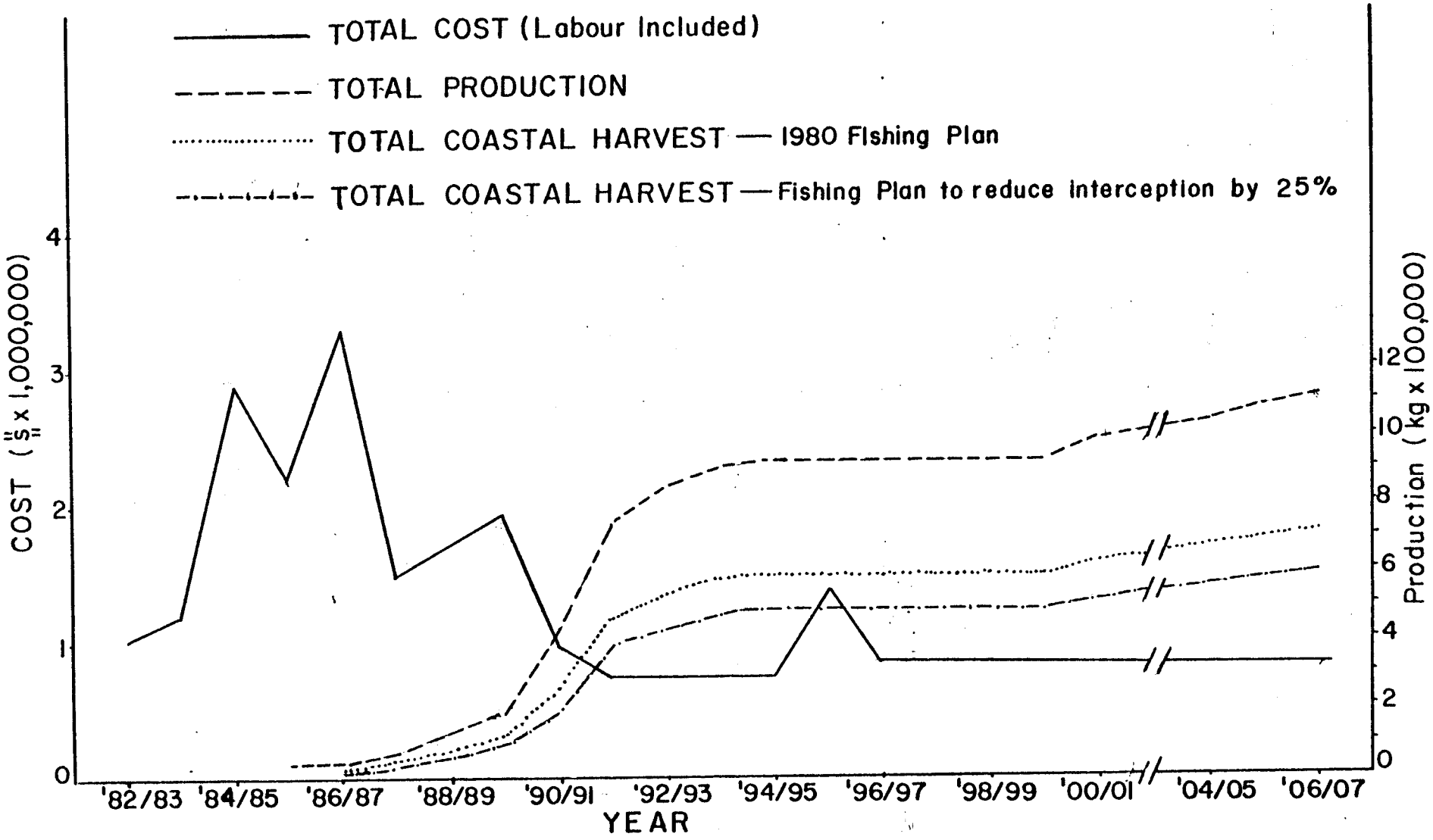


Fig. 2 Cost/Labour and Production flows for partial Newfoundland/Labrador Atlantic Salmon Enhancement Program. (Combined totals for a mix of 10 Colonization and Pond Ranching Projects.)

Watershed stocking opportunities, in the South Newfoundland coastal area, indicate that at least 1.3 million fry would be planted to increase watershed production. One potential application would produce 2 to 3 week fed fry products which would be larger than their wild counterparts. Increased size at release with subsequent increased smolt production compared to unfed fry stocking would serve to increase benefits to production options. Satellite cage rearing of fed fry in lake areas, after a 30 day period of hatchery residence, would also be explored for cost-effectiveness in terms of adult returns to local fisheries.

Once tested and refined, the technique of releasing 100,000 fed fall fingerlings to Avalon Peninsula streams would be undertaken to bolster intensive fisheries on Avalon Peninsula streams or in other heavily populated or commercial areas. (For further details on joint hatchery project, see Appendix E.)

Based on recent successes, within the Maritimes rearing program, an initial capacity for rearing 50,000 one-year smolts would also be incorporated into the Bay D'Espoir hatchery. This smolt production would support intensive high quality recreational fisheries within expanding population areas of the Avalon Peninsula. Five to ten small watersheds would be stocked each year, wherever existing or developing recreational fisheries demand justifies, on economic conservation and social grounds.

Combined Cost/Labour and Total Production for Intensive Fish Culture Projects:

	Year:	1	2	3	4	5	...	9	...	14
New Costs ($000 1981)	Rivers	50	25	86.6	1639.5	828		609		683.5
	Aquaculture	-	2863	337	690	1212		1212		1212
		50	2888	423.6	2329.5	2040		1821		1895.5

	Year:	1	2	3	4	5	...	9	...	14
New Total Production ('000 pcs)	Rivers (2.2 kg adult)									120
	Aquaculture (3.4 kg each)					145		145		160
						145		145		281

Total capital and operating cost (including labour requirements) are summarized above and detailed in Appendix E-c, along with aspects of production. Although the entire strategy has not received economic analysis, the sea farming component indicates that the levels of investment in the Bay D'espoir enterprise are recoverable within the current market place when applying appropriate discount rates and profit margins.

Opportunities to conduct salmonid aquaculture also exist on Holyrood Pond, St. Mary's Bay, Avalon Peninsula. Salt water intrusions into the pond could be employed to foster desirable aquaculture conditions if water salinity and temperature characteristics can be controlled. It is proposed to eventually mount a monitoring project to define ambient pondwater characteristics in relation to potential sites for aquaculture. The project would represent a cooperative venture between DFO, Provincial Fisheries, the Marine Sciences Research Laboratory, MUN, and the local regional development association. A 1982 review of existing environmental conditions within Holyrood Pond was recently commissioned. (For details concerning feasibility review studies, see Appendix E-b.)

4. Stream enhancement through public involvement

The primary thrust would be towards combining regulatory controls for increased river spawning escapements with stream clearance, spawning or nursery habitat improvement and stocking activities. The benefits of this enhancement strategy are often difficult to quantify; however, there is subtle accumulating evidence supporting future intensification of such enhancement to ensure continuance of runs in the numerous small watersheds of Insular Newfoundland. The strategy would allow for the rebuilding of stocks existing in a weakened or impoverished condition such as those located in or adjacent the more densely populated, industrialized areas of the Avalon Peninsula and Southwest Coast. A public involvement thrust is recommended and would include as key ingredients: education-training on enhancement through DFO community and technical advisors; grants or employment contracts; and most important, demonstrated interest and commitment of the public to enhancement.

Combined Cost/Labour and Production for Seven Public Involvement Projects:

Year:	1	2	3	4	5	7	...	12
New Costs ($000, 1981)	712.9	991.7	609.6	434.6	434.6	...		434.6
New Total Production ('000 pcs)						6.1	...	8.0

Total capital and operating cost including labour requirements are summarized above and detailed in Appendix D-b, along with aspects of production.

As a result of a series of six planning meetings held by DFO at various locations in both Newfoundland and Labrador, a total of seven proposed enhancement projects has been identified by Public and Community Groups which has been further refined by the Technical Working Group (Appendix D-b). This mix of volunteer-community projects would utilize low level investments to maintain or improve Atlantic salmonid runs while at the same time raising the awareness of the various public groups involved to the benefits and

requirements of that resource. Certain of those projects would address major long-term production goals on a cost effective basis, offering significant spinoff benefits to community employment, job training, regional development and education.

(5) Pacific salmon introductions

This strategy relates to the eventual introduction of Pacific salmon species to the Province. However, in order to ensure the integrity of existing fish species and effectiveness of the overall salmon management-enhancement approach, extensive research is first required. A 1979 CAFSAC committee report has compiled a list of pilot and feasibility studies required prior to considering such introductions (for details, see Appendix E). Hence the Core Planning Group recommends that feasibility investigations begin in Year 3 of the development plan, continue in Year 4, with the first pilot projects conducted during the second five-year phase. The total costs of the required research and development (i.e. $535,000-$1981) would be shared with other Atlantic regions interested in such introductions and which must yet be evaluated in terms of the benefits that could eventually accrue. Hence, the costs are not incorporated into the Newfoundland development plan at this time.

(6) Summary

Twenty projects have been identified under the strategies described involving development in close to 50 watersheds throughout Newfoundland-Labrador. Implementation of the colonization and public enhancement would be emphasized during the first two years of the program. The first pond ranching production projects would then come on stream in the third year while refinements for the Bay D'Espoir hatchery projects proceed. River projects based on hatchery production would be initiated as well as the first two years of research and feasibility investigations into Pacific introductions. Besides providing an economic basis for improved management and harvest benefits, an Atlantic salmon enhancement program would create greater stability and diversity for provincial society through improved employment investment and through environment or resource preservation. By the end of the ten year program, salmon landings would expand by 1500 metric tonnes within commercial fisheries or aquaculture facilities while recreational fisheries could increase by another 50,000 adult salmon. Forty-five million dollars would be invested over the program period. There would be the direct employment of an estimated 250 full time or seasonal employees each year during the start-up phase plus the creation of an additional 200 long-term jobs during the operations phase of the program. The present ten-year interim program plan when fully completed will contain sufficient projects to allow even further potential increases in the current salmon stock base and the benefits that accrue.

IV. ACKNOWLEDGMENTS

As a general coordinator for the Atlantic salmon enhancement planning exercise within DFO, I personally wish to acknowledge the dozen federal and provincial agencies who supplied 25 untiring working members to the Core and Technical Planning Groups. Those agencies and participants are listed in Appendix A. The federal agency of Canada Manpower (CEIC) must here be recognized for its special interest and financial support towards new public involvement enhancement planning initiatives such as the St. Mary's North Demonstration Project. Numerous public associations and groups must be commended for submitting and, in some cases, implementing salmon development proposals.

There were numerous contributors outside the Newfoundland Region who greatly assisted with advice on the planning activities. The efforts of DFO Enhancement staff members in the Scotia-Fundy and Pacific regions are gratefully acknowledged, as are members of the B.C. Fish and Wildlife staff, Victoria, and of the Institute of Fisheries, University of B.C., Vancouver. A special thanks goes to Ron Macleod and his Resource Enhancement staff in Ottawa for their role in arranging various East-West exchanges and interregional funding initiatives for Atlantic salmon enhancement in Newfoundland.

I am also grateful to the many typists within Fisheries Research Branch who have worked on the countless documents and tables that compose the ten-year enhancement plan.

J. D. Pratt

Exploits River

Appendix C

(a) Colonization Projects

Activity and Cost/Production Flows

Exploits River

A five-year stocking program of the middle Exploits tributaries was completed in the spring of 1980. This was accomplished utilizing swim-up fry from the Noel Paul's Brook incubation facility (incubation boxes plus spawning channel) with distribution by helicopter. This run can become self-sustaining with completion of the Grand Falls fishway (tentatively slated for 1985/86 at a capital cost of $495,000). The major portion of the Exploits River potential however, remains undeveloped, namely the tributaries above Red Indian Lake dam (upper Exploits). This area has a yearly production potential of 66,000 adults (20,000 large salmon and 46,000 grilse). Red Indian Lake dam at present is a complete obstruction.

Preliminary to a large scale stocking of the upper Exploits, a test stocking of Lloyd's River was initiated this year (1981/82) with a view to determining whether or not smolts will move through Red Indian Lake (approx. 40 miles long) and pass safely through the dam. This activity is utilizing brood from the middle Exploits and existing resources at Noel Paul's incubation facility. The deficiency in fry thus caused to the middle Exploits was compensated for with the remainder (approx. 700,000) going to Lloyds.

The first smolt migration out of Lloyd's will be in 1984/85. Concurrent with the test stocking there will be preliminary bio-baseline investigations on Lloyd's and the remaining tributaries (beginning in 1982/83) addressing in particular potential predator problems and competition as posed by existing landlocked salmon and trout populations.

If the test stocking and bio-baseline investigations indicate that large scale stocking is feasible then Noel Paul's incubation facility will be expanded in 1985/86 ($99,000 capital cost). Brood to accomodate expansion will again come from the middle Exploits with compensatory fry stockings of the donor tributaries as required. Fry stocking will begin in 1986/87 and continue until 1991/92. First smolt will appear in 1989/90 with first grilse and large salmon in 1990/91 and 1991/92 respectively.

The best method of passage of adults around or over Red Indian Lake dam will be investigated in 1982/83. A preliminary assessment indicates that a fish elevator system might be feasible. This facility would be constructed over a two year period beginning in 1986/87 at a capital cost of $800,000 the first year and $400,000 the second.

The above scenario assumes completion of the Grand Falls fishway on the middle Exploits as opposed to the truck transfer operation in effect at the present time. Considering the substantial increase in volume of fish going through this facility as a result of bringing on the upper Exploits (15,000-20,000 fish in addition to approx. 5000 at present) it is certainly more desirable from an operations viewpoint to complete the fishway. Field staff have expressed serious doubt as to whether the collection facility as it stands can physically

handle the numbers expected at peak periods. Even with two trucks operating (maximum of 100 fish per truck per trip) there could be a real risk of mortality expecially during periods of high temperature. A third truck would have to be on standby.

Cost and labour flows for the above incremental activity are presented in Table 1. Production and harvest allocation based on the 1980 fishing plan and a plan to reduce interception of non-Newfoundland/Labrador salmon by 25% are shown in Tables 2 and 3 respectively.

Harvest and Management of Salmon Produced from the Enhancement Program - Exploits River

The harvesting strategy for salmon produced by the Exploits River enhancement program is dependent on the fishing strategy which is, or will be, in effect for the east and northeast coast of Newfoundland. Fisheries and Oceans are presently considering alternative options for reducing the harvest of non-Newfoundland and Labrador origin salmon by 25%. No decision has yet been made as to the acceptability of either or any of these options. However, the acceptance of a management plan to reduce harvest of non-Newfoundland and Labrador origin salmon will have a serious impact on the harvest of Exploits River salmon and thus on impact on benefits received. In order to accommodate a possible change in east coast fishing plans harvest and management plans for Exploits River salmon were prepared for comparison using the 1980 fishing patterns and a possible fishing plan which reduces interception by 25%.

Harvesting Pattern 1980

Under the fishing regime conducted in 1980 about 66% (65,600 kg) of the total enhanced fish production (145,700 kg) would be harvested in the existing coastal set net fishery; 6% (8,800 kg) would be harvested in the recreational fishery and 20% (29,800 kg) would be required for spawning. In addition, 8% (11,520 kg) of the production would be harvested at West Greenland. Under this fishing plan there would not be sufficient surplus to warrant a commercial fishery in the river or estuary. It should be recognized that the above are average values and production as well as harvest could fluctuate by as much as 40%. Management of existing fisheries is based on average stock levels. Thus, no attempt is made to establish quotas on the annual stock levels. With regard to the Exploits River stocks, spawner escapements can be monitored at Bishop's Falls fishway. If a conservation problem is recognized, corrective action in the form of restriction to the fisheries in the immediate area can be implemented. To this end research investigations are required in Bay of Exploits to delineate the mixing of Exploits River-origin salmon and non-Exploits River-origin stocks. This investigation would take three years and require $10,000 and 1.5 person years (seasonal staff) annually using a DFO research vessel. This investigation is required for proper management of Exploits

River salmon with or without an enhancement program.

Additional management requirements also occur within the recreational fisheries. The increased numbers of fish will undoubtedly attract additional anglers and poachers. These will be distributed over a much greater area of the water course than at present. Additional conservation and protection enforcement staff will be required. Also essential to managing the recreational fishery is the collection of angled catch statistics. It is proposed that the recreational fisheries on the Exploits be managed as an exclusive unit from other river systems. A weekly angling licence system would be implemented; thus providing accurate data on angling effort. This information would be combined with a creel census program carried out by the Conservation and Protection Branch field staff or placed on contract through C & P. A weekly licencing system provides a method of strict control of catch and effort in the recreational fishery as well as providing an avenue for cost recovery program.

Harvest and Management Plan Relative to a Program to Reduce Harvest of Non-Newfoundland-Labrador origin salmon by 25%

The implementation of a program to reduce interception by 25% could result in a corresponding decrease of 25% in the harvest of Exploits River origin salmon in the coastal commercial fishery. Thus, 23,800 kg of additional salmon would be released into the Exploits River. Several problems arise for fisheries management in developing a fishery to harvest these fish in or near the river system. These include: annual prediction of numbers of fish returning each year; the timing and mixing of salmon from various tributaries in a relatively small area; the duration of the run to the river; and a fish level of control must be placed on the fishery. Basically there are three options available for fisheries managers to chose from: 1) No commercial fisheries, however the fish would be subjected to a harvest by the anglers and the surplus available harvest would be considered lost; 2) Permit a recreational harvest and harvest the surplus salmon in a terminal-type fishery at the Red Indian Lake dam; 3) Conduct an estuarial trap net fishery for fish released from the coastal fishery. These options are briefly discussed below.

Option 1

The 23,800 kg of salmon released from the coastal fishery would be exploited only by the angling fishery. It is projected that under this option the anglers would harvest 20% or 4800 kg. This is equivalent to about 2,200 fish. The total loss of harvestable fish would be 16,700 kg. These fish would be distributed throughout the upper Exploits River watershed.

The management of the fisheries under this option would be the same as indicated for the fishing plan without reduction in coastal fisheries. That is investigation into stock identification within Bay of Exploits and a new weekly licencing system.

Option II

Under the option the additional 23,800 kg of salmon would migrate upstream and be subjected to an angling fishery enroute. Anglers would remove about 20% (4,800 kg or 2,200 fish) leaving about 16,700 kg to be harvested at Red Indian Lake dam at Millertown. These fish could be removed from the fishway or collection facility and trucked directly to market. There are some inherent questions regarding this option which places some doubt that benefits will accrue as stated. Salmon will probably be in the river for four to five weeks prior to reaching Red Indian Lake. During this time there could be a significant weight loss, as well as being subjected to possible illegal fisheries. More important, by the time fish reach Red Indian Lake, the quality of the fish could be poor and not acceptable for market.

The management of the recreational fishery and the terminal fishery would have a similar requirement as in Option I, with one additional biological requirement. A technique would have to be developed to forecast returns to Red Indian Lake. The cost of biological operations would be about two person years and $20,000.

Option III

This option involves the commercial harvest of the 23,800 kg of salmon (released from the coastal fishery) in a trap net fishery in the estuary of the

the Exploits River. This fishery would operate either under a quota which would be spread out over the duration of the salmon run (about 4 weeks) or permitted to fish a certain number of days a week. There are a number of biological problems which must be overcome before an estuarial fishery can be managed properly. These include, but are not limited to: 1) development of a technique to forecast available harvest in the estuary; 2) delineation of the proportion of the salmon in the estuary which have origins in other rivers; 3) the impact of an estuarial fishery on other river stocks; 4) the length of time salmon remain in the estuary before migrating upriver; 5) the time of arrival of salmon destined for various tributaries in the Exploits; and 6) a technique has to be developed to determine if the tributaries are being adequately seeded.

In order to maintain an estuarial fishery, annual assessments will be required to determine status of the stocks and forecast available harvest. The quota will also have to be strictly enforced; thus requiring the services of C & P.

The recreational fishery would operate under a weekly licencing system as previously mentioned.

The resource requirements for Option III would be 2 PY of permanent staff and 1.5 PY of term staff. The annual operating budget would be $30,000 and implementation of investigations should begin during the first year that enhancement activities commenced.

These resources do not include the conservation and protection requirements.

Table 1. Cost ($1981 x 1000) and person year (no.) flows for a mix of 10 pond ranching and colonization projects for a partial Newfoundland/Labrador Atlantic Salmon Enhancement Program.

Project	82/83	83/84	84/85	85/86	86/87	87/88	88/89	89/90	90/91	91/95	95/96	96/97, etc.
*Exploits River[a]												
Person Years (No.)												
Permanent	2.3	2.4	2.4	3.6	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Other	5.2	5.5	5.5	8.1	6.4	7.3	6.9	6.9	7.2	4.2	4.2	4.2
Capital (x $1000)	8.8	-	55.0	627.0	880.0	440.0	-	-	-	-	-	-
O/M (x $1000)	97.4	98.5	98.5	137.0	112.0	115.0	114.0	114.0	116.0	61.0	61.0	61.0
Humber River[a]												
Person Years (No.)												
Permanent	0.8	0.6	0.6	0.8	0.4	0.5	0.2	0.2	0.2	-	-	-
Other	0.9	0.8	0.8	0.8	0.7	1.3	0.7	0.7	0.7	0.7	0.7	0.7
Capital (x $1000)	22.0	1.1	1.1	-	495.0	-	-	-	-	-	-	-
O/M (x $1000)	13.2	38.5	38.5	38.5	33.0	49.5	17.6	17.6	17.6	17.6	17.6	17.6
Terra Nova River[a]												
Person Years (No.)												
Permanent	0.4	0.7	0.3	0.3	0.3	0.4	0.1	0.1	0.1	-	-	-
Other	0.8	1.3	0.7	0.7	0.7	1.5	0.8	0.8	0.8	0.8	0.8	0.8
Capital (x $1000)	6.6	5.5	-	-	-	-	-	-	-	-	-	-
O/M (x $1000)	27.5	44.0	22.0	22.0	22.0	110.0	5.5	5.5	5.5	5.5	3.3	3.3
Canairiktok River[a]												
Person Years (No.)												
Permanent	0.3	0.4	1.2	0.7	0.3	0.6	0.3	0.3	-	-	-	-
Other	0.8	1.4	4.2	4.8	2.7	2.3	0.3	0.3	1.3	1.3	1.3	1.3
Capital (x $1000)	23.1	55.0	1650.0	16.5	-	-	825.0	1045.0	-	-	-	-
O/M (x $1000)	17.6	14.3	75.9	61.6	52.8	41.8	56.0	56.0	32.0	32.0	32.0	32.0
Black Brook[b]												
Person Years (No.)												
Permanent	1.3	0.3	0.8	0.8	0.8	0.8	0.4	0.4	0.4	0.4	0.4	0.4
Other	2.8	1.2	1.7	1.7	1.7	1.9	1.4	1.4	1.4	1.4	1.4	1.4
Capital (x $1000)	462.0	-	-	-	-	-	-	-	-	-	-	-
O/M (x $1000)	31.4	28.6	29.7	29.7	29.7	30.8	29.7	29.7	29.7	29.7	29.7	29.7
Robinsons River[b]												
Person Years (No.)												
Permanent	-	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	2.0	2.0
Other	-	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	2.0	2.0
Capital (x $1000)	-	495.0	-	-	-	-	-	-	-	-	440.0	-
O/M (x $1000)	-	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0

Table 1 (cont'd)

Project	82/83	83/84	84/85	85/86	86/87	87/88	88/89	89/90	90/91	91/95	95/96	96/97, etc.
Indian Bay Brook[b]												
Person Years (No.)												
Permanent	-	-	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	2.0	2.0
Other	-	-	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.8	1.8
Capital (x $1000)	-	-	440.0	-	-	-	-	-	-	-	110.0	-
O/M (x $1000)	-	-	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	22.0	22.0
Gander Bay[b]												
Person Years (No.)												
Permanent	-	0.4	0.1	0.6	0.3	0.8	0.8	0.8	0.5	0.4	0.4	0.4
Other	-	0.6	0.3	2.0	1.8	2.3	2.3	2.3	2.7	2.4	2.4	2.4
Capital (x $1000)	-	-	1.1	550.0	-	-	-	-	-	-	-	-
O/M (x $1000)	-	3.3	5.5	28.6	34.1	35.2	35.2	35.2	38.5	37.4	37.4	37.4
Torrent River[b]												
Person Years (No.)												
Permanent	-	-	0.3	0.3	0.2	0.3	1.6	1.6	0.8	0.8	0.8	0.8
Other	-	-	0.4	1.0	1.2	2.7	4.2	4.2	4.2	4.2	4.2	4.2
Capital (x $1000)	-	-	-	3.3	550.0	-	-	-	-	-	-	-
O/M (x $1000)	-	-	11.0	20.0	67.1	40.7	45.1	45.1	45.1	45.1	45.1	45.1
South Brook[b]												
Person Years (No.)												
Permanent	-	-	-	-	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Other	-	-	-	-	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
Capital (x $1000)	-	-	-	-	495.0	-	-	-	-	-	-	-
O/M (x $1000)	-	-	-	-	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0
Totals												
Person Years (No.)												
Permanent	5.1	5.8	7.7	9.1	7.3	8.4	8.4	8.4	7.0	6.6	8.6	8.6
Other	10.5	11.6	15.8	21.3	18.8	22.9	20.2	20.2	21.9	18.6	20.2	20.2
Capital (x $1000)	522.5	556.6	2147.2	1196.8	2420.0	440.0	825.0	1045.0	-	-	550.0	-
O/M (x $1000)	187.1	249.2	314.1	370.4	405.7	478.0	358.1	352.6	339.4	283.3	292.1	292.1

*Exploits River flow includes estuarial harvest manageability costs plus labour (annually - 2.0 permanent + 1.5 other PY; $30,000 O/M).

a = colonization project; b = pond ranching project.

Note: O/M does not include labour costs. Average permanent PY = $27,000; average "other" PY = $19,000.

Table 2. Allocation and utilization of Atlantic salmon by number and weight for Exploits River (upper watershed). Based on 1980 fishing plan. Colonization project.

	Production		Brood		Tot. coastal		Harvest by Statistical Area										Recreational		West Greenland		Estuarial harvest	
							A		B		C		D		E							
	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg
1986/87																						
Grilse	10,800	19,800	2,200	3,300	7,200	14,400	1,400	2,800	4,700	9,400	700	1,400	400	800	-	-	1,400	2,100	-	-	-	-
Total	10,800	19,800	2,200	3,300	7,200	14,400	1,400	2,800	4,700	9,400	700	1,400	400	800	-	-	1,400	2,100	-	-	-	-
1987/90																						
Grilse	10,800	19,800	2,200	3,300	7,200	14,400	1,400	2,800	4,700	9,400	700	1,400	400	800	-	-	1,400	2,100	-	-	-	-
Lg salmon	5,100	16,400	100	300	3,900	12,500	700	2,200	1,800	5,800	800	2,600	400	1,300	200	600	100	400	1,000	3,200	-	-
Total	15,900	36,200	2,300	3,600	11,100	26,900	2,100	5,000	6,500	15,200	1,500	4,000	800	2,100	200	600	1,500	2,500	1,000	3,200	-	-
1990/91																						
Grilse	46,000	81,700	15,600	23,400	25,400	50,800	5,100	10,200	16,500	33,000	2,500	5,000	1,300	2,600	-	-	5,000	7,500	-	-	-	-
Lg salmon	5,100	16,400	100	300	3,900	12,500	700	2,200	1,800	5,800	800	2,600	400	1,300	200	600	100	400	1,000	3,200	-	-
Total	51,100	98,100	15,700	23,700	29,300	63,300	5,800	12,400	18,300	38,800	3,300	7,600	1,700	3,900	200	600	5,100	7,900	1,000	3,200	-	-
1991/92, etc.																						
Grilse	4,600	81,700	15,600	23,400	25,400	50,800	5,100	10,200	16,500	33,000	2,500	5,000	1,300	2,600	-	-	5,000	7,500	-	-	-	-
Lg salmon	20,000	64,000	2,000	6,400	14,000	44,800	2,800	9,000	6,300	20,100	2,800	9,000	1,400	4,500	700	2,200	400	1,300	3,600	11,500	-	-
Total	66,000	145,700	17,600	29,800	39,400	95,600	7,900	19,200	22,800	53,100	5,300	14,000	2,700	7,100	700	2,200	5,400	8,800	3,600	11,500	-	-

Table 3. Allocation and utilization of Atlantic salmon by number and weight for Exploits River (upper watershed). Based on a fishing plan to reduce interception of non-Newfoundland/Labrador salmon by 25%. Colonization project.

	Production		Brood		Tot. coastal		Harvest by Statistical Area															
							A		B		C		D		E		Recreational		West Greenland		Estuarial harvest	
	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg
1986/87																						
Grilse	10,800	19,800	2,200	3,300	5,500	3,300	1,100	2,200	3,600	7,200	500	1,000	300	600	-	-	1,400	2,100	-	-	1,700	3,400
Total	10,800	19,800	2,200	3,300	5,500	3,300	1,100	2,200	3,600	7,200	500	1,000	300	600	-	-	1,400	2,100	-	-	1,700	3,400
1987/90																						
Grilse	10,800	19,800	2,200	3,300	5,500	11,000	1,100	2,200	3,600	7,200	500	1,000	300	600	-	-	1,400	2,100	-	-	1,700	3,400
Lg salmon	5,100	16,400	100	300	2,800	9,000	600	1,900	1,300	4,200	500	1,600	300	1,000	100	300	100	400	1,000	3,200	1,100	3,500
Total	15,900	36,200	2,300	3,600	8,300	20,000	1,700	4,100	4,900	11,400	1,000	2,600	600	1,600	100	300	1,500	2,500	1,000	3,200	2,800	6,900
1990/91																						
Grilse	46,000	81,700	15,600	23400	19,600	39,200	4,100	8,200	12,700	25,400	1,800	3,600	1,000	2,000	-	-	5,000	7,500	-	-	5,800	11,600
Lg salmon	5,100	16,400	100	300	2,800	9,000	600	1,900	1,300	4,200	500	1,600	300	1,000	100	300	100	400	1,000	3,200	1,100	3,500
Total	51,100	98,100	15,700	23,700	22,400	48,200	4,700	10,100	14,000	29,600	2,300	5,200	1,300	3,000	100	300	5,100	7,900	1,000	3,200	6,600	15,100
1991/92, etc.																						
Grilse	46,000	81,700	15,600	23,400	19,600	39,200	4,100	8,200	12,700	25,400	1,800	3,600	1,000	2,000	-	-	5,000	7,500	-	-	5,800	11,600
Lg salmon	20,000	64,000	2,000	6,400	10,200	32,700	2,200	7,000	4,900	15,700	1,800	5,800	1,000	3,200	300	1,000	400	1,300	3,600	11,500	3,800	12,100
Total	66,000	145,700	17,600	29,800	29,800	71,900	6,300	15,200	17,600	41,100	3,600	9,400	2,000	5,200	300	1,000	5,400	8,800	3,600	11,500	9,600	23,700

Humber River

Humber River

The section of the Humber River above Main Falls (a complete obstruction) has an estimated production potential of 17,100 adult salmon (12,000 grilse and 5,100 large salmon). A colonization strategy utilizing adult transfers is proposed to achieve this level of production.

Preliminary baseline studies could begin in 1982/83; these should include electrofishing and trap net surveys to assess possible competition from land locked salmon and brook trout, assessment of spawning requirements and current escapement of salmon stocks in rivers designated as potential sources of broodstock (Adies River) and a hydrologic survey as proposed to begin in 1983/84 at Main Falls. If preliminary studies indicate feasibility, a fishway could be built (capital cost $450,000) on Main Falls in 1986/87 (this could be spread over two years). First smolts could appear in 1987/88 with first grilse and large salmon one and two years later respectively.

Costs and labour flows are shown in Table 1; production and harvest allocation based on the 1980 fishing plan and a plan to reduce interception of non-Newfoundland/Labrador salmon by 25% are shown in Tables 4 & 5 respectively.

Table 5. Allocation and utilization of Atlantic salmon by weight (kg) and number (in parentheses) for Humber River. Based on a fishing plan to reduce interception of non-Newfoundland/Labrador salmon by 25%. Colonization project.

	Production	Brood	Tot. coastal	Harvest by Statistical Area											Recreational	West Greenland
				A	B	C	D	E	F	H	I	J	K	L		
1988/89																
Grilse	21,400	6,200	13,200	-	-	-	-	-	-	-	-	900	2,800	9,500	-	-
	(12,000)	(4,100)	(6,600)	-	-	-	-	-	-	-	-	(460)	(1,380)	(4,760)	-	-
Total	21,400	6,200	13,200	-	-	-	-	-	-	-	-	900	2,800	9,500	-	-
	(12,000)	(4,100)	(6,600)	-	-	-	-	-	-	-	-	(460)	(1,380)	(4,760)	-	-
1989/90, etc.																
Grilse	21,400	6,200	13,200	-	-	-	-	-	-	-	-	900	2,800	9,500	-	-
	(12,000)	(4,100)	(6,600)	-	-	-	-	-	-	-	-	(460)	(1,380)	(4,760)	-	-
Lg salmon	16,300	1,600	10,800	450	350	350	200	200	200	350	450	1,300	2,900	4,050	1,000	2,900
	(5,100)	(500)	(3,280)	(140)	(110)	(110)	(70)	(70)	(70)	(110)	(140)	(400)	(900)	(1,260)	(320)	(900)
Total	37,700	7,800	24,000	450	350	350	200	200	200	350	450	2,200	5,700	13,550	1,000	2,900
	(17,100)	(4,600)	(10,200)	(140)	(110)	(110)	(70)	(70)	(70)	(110)	(140)	(860)	(2,280)	(6,020)	(320)	(900)

* Additional harvest has been allocated to the recreational fishery

Table 4. Allocation and utilization of Atlantic salmon by weight (kg) and number (in parentheses) for Humber River. Based on 1980 fishing plan. Colonization project.

	Production	Brood	Tot. coastal	Harvest by Statistical Area											Recreational	West Greenland
				A	B	C	D	E	F	H	I	J	K	L		
1988/89																
Grilse	21,400	6,200	13,200	-	-	-	-	-	-	-	-	1,300	2,600	9,300	2,000	-
	(12,000)	(4,100)	(6,600)	-	-	-	-	-	-	-	-	(660)	(1,320)	(4,620)	(1,300)	-
Total	21,400	6,200	13,200	-	-	-	-	-	-	-	-	1,300	2,600	9,300	2,000	-
	(12,000)	(4,100)	(6,600)	-	-	-	-	-	-	-	-	(660)	(1,320)	(4,620)	(1,300)	-
1989/90, etc.																
Grilse	21,400	6,200	13,200	-	-	-	-	-	-	-	-	1,300	2,600	9,300	2,000	-
	(12,000)	(4,100)	(6,600)	-	-	-	-	-	-	-	-	(660)	(1,320)	(4,620)	(1,300)	-
Lg salmon	16,300	1,600	11,500	600	600	600	600	600	600	600	600	1,700	2,200	2,800	300	2,900
	(5,100)	(500)	(3,600)	(180)	(180)	(180)	(180)	(180)	(180)	(180)	(180)	(540)	(720)	(900)	(100)	(900)
Total	37,700	7,800	24,700	600	600	600	600	600	600	600	600	3,000	4,800	12,100	2,300	2,900
	(17,100)	(4,600)	(10,200)	(180)	(180)	(180)	(180)	(180)	(180)	(180)	(180)	(1,200)	(2,040)	(5,520)	(1,400)	(900)

Terra Nova River

Terra Nova River

The section of the Terra Nova River above Mollyquajack Falls (complete obstruction) has a production potential of 7300 adult salmon (5100 grilse and 2200 large salmon). A colonization strategy utilizing an adult transfer is proposed as a means of bringing on this production.

Preliminary bio-baseline studies will begin in 1982/83. These will involve electrofishing and trapnet surveys as described above for the Exploits and Humber. The lower Terra Nova River will be used as a brood source. It is felt that the obstruction of Mollyquajack Falls could be removed by remedial blasting ($88,000) in 1987/88. First smolt will appear in 1987/88. First grilse will be encountered in 1988/89 with first large salmon one year later. Cost and labour flows for such activity are shown in Table 1; production and harvest allocation based on the 1980 fishing plan and a aplan to reduce interception of non-Newfoundland/Labrador salmon by 25% are shown in Tables 6 and 7 respectively.

Table 6. Allocation and utilization of Atlantic salmon by number and weight for Terra Nova River. Based on 1980 fishing plan. Colonization project.

	Production		Brood		Tot. coastal		Harvest by Statistical Area										Recreational		West Greenland		Estuarial harvest	
							A		B		C		D		E							
	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg
1987/88																						
Grilse	5,100	9,100	1,600	2,400	2,800	5,600	-	-	400	800	1,900	3,800	400	800	100	200	700	1,100	-	-	-	-
Total	5,100	9,100	1,600	2,400	2,800	5,600	-	-	400	800	1,900	3,800	400	800	100	200	700	1,100	-	-	-	-
1988/89, etc.																						
Grilse	5,100	9,100	1,600	2,400	2,800	5,600	-	-	400	800	1,900	3,800	400	800	100	200	700	1,100	-	-	-	-
Lg salmon	2,200	7,000	200	600	1,500	4,800	100	300	300	1,000	700	2,200	300	1,000	100	300	100	300	400	1,300	-	-
Total	7,300	16,100	1,800	3,000	4,300	10,400	100	300	700	1,800	2,600	6,000	700	1,800	200	500	800	1,400	400	1,300	-	-

Table 7. Allocation and utilization of Atlantic salmon by number and weight for Terra Nova River. Based on a fishing plan to reduce interception of non-Newfoundland/Labrador salmon by 25%. Colonization project.

	Production		Brood		Tot. coastal		Harvest by Statistical Area										Recreational		West Greenland		Estuarial harvest	
							A		B		C		D		E							
	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg
1987/88																						
Grilse	5,100	9,100	1,600	2,400	2,100	4,200	-	-	300	600	1,400	2,800	300	600	100	200	700	1,100	-	-	300	600
Total	5,100	9,100	1,600	2,400	2,100	4,200	-	-	300	600	1,400	2,800	300	600	100	200	700	1,100	-	-	300	600
1988/89, etc.																						
Grilse	5,100	9,100	1,600	2,400	2,100	4,200	-	-	300	600	1,400	2,800	300	600	100	200	1,100	1,900	-	-	300	600
Lg salmon	2,200	7,000	200	600	1,000	3,200	100	300	200	600	500	1,600	200	700	-	-	200	600	400	1,300	400	1,300
Total	7,300	16,100	1,800	3,000	3,100	7,400	100	300	500	1,200	1,900	4,400	500	1,300	100	200	1,300	2,500	400	1,300	700	1,900

Canairiktok River

Canairiktok River

This Labrador River is completely obstructed by two major falls located at the mouth. It has a production potential of 36,500 adult salmon (14,600 grilse and 21,900 large salmon). The proposed method of bringing on this production is colonization utilizing fry (transfer by helicopter).

Preliminary baseline investigations (beginning in 1982/83) will include a disease survey on Canairiktok River and Hunt River (brood source), electro-fishing/trapnet surveys on areas to be stocked and an adult assessment on Flowers River. An incubation facility will be built at the lower falls in 1984/85 at a capital cost of $650,000. The obstruction at the upper falls will be removed by means of a fishway in 1988/89 at a cost of $825,000; a fishway on the lower falls will be completed in 1989/90 (cost of $1,045,000). First smolt (assuming a 4+ smolt) will appear in 1989/90; first grilse and large salmon will appear one and two years later respectively. Cost and labour flows for the above are shown in Table 1; production and harvest allocation based on the 1980 fishing plan and a plan to reduce interception of non-Newfoundland/Labrador salmon by 25% are presented in Tables 8 and 9 respectively.

Table 8. Allocation and utilization of Atlantic salmon by number and weight for Canairiktok River. Based on 1980 fishing plan. Colonization project.

	Production		Brood		Tot. coastal		Harvest by Statistical Area						Recreational		West Greenland		Additional harvest	
							A		B		O							
	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg
1990/91																		
Grilse	14,600	26,500	7,900	13,400	5,800	11,600	600	1,200	300	600	4,900	9,800	900	1,500	-	-	-	-
Total	14,600	26,500	7,900	13,400	5,800	11,600	600	1,200	300	600	4,900	9,800	900	1,500	-	-	-	-
1991/92, etc.																		
Grilse	14,600	26,500	7,900	13,400	5,800	11,600	600	1,200	300	600	4,900	9,800	900	1,500	-	-	-	-
Lg salmon	21,900	94,200	3,600	15,500	14,200	61,000	2,800	12,000	700	3,000	10,700	46,000	200	900	3,900	16,800	-	-
Total	36,500	120,700	11,500	28,900	20,000	72,600	3,400	13,200	1,000	3,600	15,600	55,800	1,100	2,400	3,900	16,800	-	-

Table 9. Allocation and utilization of Atlantic salmon by number and weight for Canairiktok River. Based on a fishing plan to reduce interception of non-Newfoundland/Labrador salmon by 25%. Colonization project.

	Production		Brood		Tot. coastal		Harvest by Statistical Area						Recreational		West Greenland		Additional harvest	
							A		B		0							
	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg
1990/91																		
Grilse	14,600	26,500	7,900	13,400	5,700	11,400	500	1,000	200	400	5,000	10,000	900	1,500	-	-	100	200
Total	14,600	26,500	7,900	13,400	5,700	11,400	500	1,000	200	400	5,000	10,000	900	1,500	-	-	100	200
1991/92, etc.																		
Grilse	14,600	26,500	7,900	13,400	5,700	11,400	500	1,000	200	400	5,000	10,000	900	1,504	-	-	100	200
Lg salmon	21,900	94,200	3,600	15,500	13,800	59,300	2,300	9,900	400	1,700	11,100	47,700	200	900	3,900	16,800	400	1,700
Total	36,500	120,700	11,500	28,900	19,500	70,700	2,800	10,900	600	2,100	16,100	57,700	1,100	2,500	3,900	16,800	500	1,900

(b) Pond Ranching Projects

Indian Brook (Pilot Pond Ranching, Black Brook)

(b) Pond Ranching Projects

Indian Brook (Pilot Pond Ranching Project)

The Indian Brook, Atlantic salmon enhancement project is designed as a group of integrated activities based on fry production from a deep substrate incubator facility located on Black Brook (a tributary of the Indian Brook system). As a pilot project to prove the value of diversifying Newfoundland's enhancement activities, Indian Brook enhancement will draw on swim-up fry distribution to standing waters (as compared to stream stocking previously empolyed within the province), rearing channel operation, cage culture, and maintenance stocking.

With a total river length of 300 km, a natural production capacity for Indian Brook Atlantic salmon is limited to 15,000 adults per year. Present experiments into lacustrine nursery areas for juvenile salmon suggest that based on lake stocking with young salmon, the Indian Brook system could support an annual production in the vicinity of 40,000 to 70,000 adults per year. Thus, initial stages of a renewed enhancement effort on Indian Brook will strive to prove the technical desirability of this evolving strategy (i.e. pond ranching). However, concurrent with pilot activities, the Newfoundland Region will apply technologies (i.e. juvenile rearing), which have proven effective in other parts of North America, to determine their potential for application to the Newfoundland biological and climatic regime. Utilizing a sequential (and therefore cautious) approach to these evaluations, initial experiments into parr rearing were undertaken in 1981 and have confirmed the Region's confidence in the potential cost effectiveness of this strategy. With fry rearing as a potential means of increasing natural water system carrying capacity, Newfoundland Region will undertake construction of the Black Brook incubation facility in 1982/93 and will apply the facilities first fry year-classes to the full range of activities identified above.

Designed as a three phase construction operation, the Black Brook facility will be limited to two deep substrate incubators in 1982 but will be expanded, depending on initial production results, to four incubator units in 1986. Should these four units operate efficiently enough to withstand rigorous biological, engineering and economic analysis criteria through to 1990, incubation capacity could then be doubled.

With first phase construction in 1982/83 1.1 million salmon fry will be available for distribution in 1983/84. Of these fry, 0.75 million will be used in the pilot lacustrine stocking activity, 0.25 million will be applied to the Indian Brook rearing channel and 0.1 million will be reared in the cage culture facility. On expansion of the Black Brook facility in 1986, each of these rearing options would be double. Terminal harvest of enhanced adults surplus to brood needs is a consideration at the Black Brook facility itself.

With significant expansion potential, the project could cater to maintenance stocking in the three other salmon producing rivers in the area. Thus, the third phase of Black Brook facility construction (1990/91) would take place only if such maintenance stockings were necessary.

Initial capital costs for the Indian Brook project will be $462,000 (construction of incubation facility at Black Brook in 1982/83). Cost and labour flows for the above activity are shown in Table 1; production and harvest allocation based on the 1980 fishing plan and a plan to reduce

interception of non-Newfoundland/Labrador salmon by 25% are shown in Tables 10 and 11 respectively.

Should the need arise to incorporate a public involvement component into the Indian Brook project, a site has been chosen approximately 10 km by paved highway from the community of Springdale. This site would accommodate a second rearing channel and could be constructed largely by manual labour. Thus, a community fisheries involvement project, to rear in excess of 0.1 million smolt per year, could be undertaken at the Springdale site under some form of local employment assistance program.

With such a range of salmon enhancement activities, the Indian Brook project will provide a cornerstone to a Newfoundland component of an Atlantic Canada, Salmon Enhancement Program.

Table 10. Allocation and utilization of Atlantic salmon by number and weight for Black Brook. Production is 100% grilse. Based on 1980 fishing plan. Pond ranching pilot.

	Production		Brood		Tot. coastal		Harvest by Statistical Area															
							A		B		C		D		E		Recreational		West Greenland		Additional harvest	
	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg
1986/87																						
Total	11,800	21,000	800	1,200	6,500	13,000	1,300	2,600	4,200	8,400	700	1,400	300	600	-	-	1,600	2,400	-	-	2,900	4,400
1987/92																						
Total	23,600	42,000	1,600	2,400	13,000	26,000	2,600	5,200	8,500	16,800	1,300	2,800	600	1,200	-	-	3,200	4,800	-	-	5,800	8,800
1992/93																						
Total	35,600	63,000	1,600	2,400	19,600	39,200	3,900	7,800	12,700	25,400	2,000	4,000	1,000	2,000	-	-	4,800	7,200	-	-	9,600	14,400
1993/94, etc.																						
Total	45,600	81,000	1,600	2,400	25,000	50,000	5,000	10,000	16,300	32,600	2,500	5,000	1,200	2,400	-	-	6,200	9,400	-	-	12,800	19,200

Table 11. Allocation and utilization of Atlantic salmon by number and weight for Black Brook. Production is 100% grilse. Based on a fishing plan to reduce interception of non-Newfoundland/Labrador salmon by 25%. Pond ranching pilot.

	Production		Brood		Tot. coastal		Harvest by Statistical Area										Recreational		West Greenland		Additional harvest	
							A		B		C		D		E							
	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg
1986/87																						
Total	11,800	21,000	800	1,200	5,100	10,200	1,000	2,000	3,300	6,600	500	1,000	300	600	-	-	2,000	3,300	-	-	3,900	6,300
1987/92																						
Total	23,600	42,000	1,600	2,400	10,200	20,400	2,000	4,000	6,600	13,200	1,000	2,000	600	1,200	-	-	4,000	6,500	-	-	7,800	12,600
1992/93																						
Total	35,600	63,000	1,600	2,400	15,100	30,200	3,100	6,200	9,800	19,600	1,400	2,800	800	1,600	-	-	6,200	10,000	-	-	12,700	20,400
1993/94, etc.																						
Total	45,600	81,000	1,600	2,400	19,300	38,600	4,000	8,000	12,500	25,000	1,800	3,600	1,000	2,000	-	-	7,900	12,800	-	-	16,300	27,000

Robinsons River

Robinsons River and Satellites

The results of research over the past several years at Black Brook (Indian Brook) have shown that it is possible to produce adult Atlantic salmon from fry stocked into ponds. Although results to date are inconclusive and the upper limit of production has not been identified, it has been decided to incorporate five other pond ranching projects (described below) into the partial Newfoundland enhancement program at this time, beginning with Robinsons River. This river could support up to a total annual production of 40,000 adults applying the ranching strategy (31,000 grilse and 9,000 large salmon) assuming that salmon are currently not using standing waters for rearing. An incubation facility could be constructed in 1983/84 at a capital cost of $495,000 and expanded in 1995/96 to accommodate satellite stocking into Crabbes River, Highlands River, Fischels River and Flat Bay River to produce up to 50,800 additional fish (63,560 grilse and 27,240 large salmon). An adult holding facility could be constructed at each satellite river; adults stripped at each satellite; green eggs transported to Robinsons River for incubation and fry distributed back to the rivers of origin. The cost of expansion of the incubation facility at Robinsons plus the adult holding facilities would be $440,000. First grilse for Robinsons River could appear in 1988/89 and large salmon in 1989/90.

Cost and labour flows are presented in Table 1; production and harvest allocation based on the 1980 fishing plan and a plan to reduce interception of non-Newfoundland/Labrador salmon by 25% are shown in Tables 12-13 and 14-15 respectively.

Table 12. Allocation and utilization of Atlantic salmon by number for Robinsons River and satellites. Based on 1980 fishing plan. Pond ranching project.

	Production	Brood	Tot. coastal harvest	Harvest by Statistical Area										Recreational	West Greenland	Additional harvest
				A	B	C	D	E	F	H	I	J	K			
1988/89																
Grilse	10,500	1,542	5,775	-	-	-	-	-	-	-	-	1,155	4,620	1,155	-	2,028
Total	10,500	1,542	5,775	-	-	-	-	-	-	-	-	1,155	4,620	1,155	-	2,028
1989/93																
Grilse	10,500	1,542	5,775	-	-	-	-	-	-	-	-	1,155	4,620	1,155	-	2,028
Lg salmon	4,500	450	3,150	158	158	158	158	158	158	158	158	630	1,260	90	810	-
Total	15,000	1,992	8,925	158	158	158	158	158	158	158	158	1,785	5,880	1,245	810	2,028
1993/94																
Grilse	31,000	3,083	17,050	-	-	-	-	-	-	-	-	3,410	13,640	3,410	-	7,547
Lg salmon	4,500	450	3,150	158	158	158	158	158	158	158	158	630	1,260	90	810	-
Total	35,500	3,533	20,200	158	158	158	158	158	158	158	158	4,040	14,900	3,500	810	7,547
1994/00																
Grilse	31,000	3,083	17,050	-	-	-	-	-	-	-	-	3,410	13,640	3,410	-	7,547
Lg salmon	9,000	900	6,300	315	315	315	315	315	315	315	315	1,260	2,520	180	1,620	-
Total	40,000	3,983	23,350	315	315	315	315	315	315	315	315	4,670	16,160	3,590	1,620	7,547
2000/01																
Grilse	43,050	6,218	23,678	-	-	-	-	-	-	-	-	4,736	18,942	4,736	-	8,418
Lg salmon	9,000	900	6,300	315	315	315	315	315	315	315	315	1,260	2,520	180	1,620	-
Total	52,050	7,118	29,978	315	315	315	315	315	315	315	315	5,996	21,462	4,916	1,620	8,418
2001/05																
Grilse	43,050	6,218	23,678	-	-	-	-	-	-	-	-	4,736	18,942	4,736	-	8,418
Lg salmon	18,450	1,845	12,915	646	646	646	646	646	646	646	646	2,583	5,166	369	3,321	-
Total	61,500	8,063	36,593	646	646	646	646	646	646	646	646	7,319	24,108	5,105	3,321	8,418
2005/06																
Grilse	63,560	12,488	34,958	-	-	-	-	-	-	-	-	6,992	27,966	6,992	-	9,122
Lg salmon	18,450	1,845	12,915	646	646	646	646	646	646	646	646	2,583	5,166	369	3,321	-
Total	82,010	14,333	47,873	646	646	646	646	646	646	646	646	9,575	33,132	7,361	3,321	9,122
2006/07, etc.																
Grilse	63,560	12,488	34,958	-	-	-	-	-	-	-	-	6,992	27,966	6,992	-	9,122
Lg salmon	27,240	2,724	19,068	953	953	953	953	953	953	953	953	3,814	7,627	545	4,903	-
Total	90,800	15,212	54,026	953	953	953	953	953	953	953	953	10,806	35,593	7,537	4,903	9,122

Table 13. Allocation and utilization of Atlantic salmon by number for Robinsons River and satellites. Based on a fishing plan to reduce interception of non-newfoundland/Labrador salmon by 25%. Pond ranching project.

Lg salmon	Production	Brood	Tot. coastal harvest	Harvest by Statistical Area										Recreational	West Greenland	Additional harvest
				A	B	C	D	E	F	H	I	J	K			
1988/89																
Grilse	10,500	1,542	5,602	-	-	-	-	-	-	-	-	809	4,793	1,155	-	2,201
Total	10,500	1,542	5,602	-	-	-	-	-	-	-	-	809	4,793	1,155	-	2,201
1989/93																
Grilse	10,500	1,542	5,602	-	-	-	-	-	-	-	-	809	4,793	1,155	-	2,201
Lg salmon	4,500	450	2,742	126	95	95	63	63	63	95	126	441	1,575	90	810	408
Total	15,000	1,992	8,344	126	95	95	63	63	63	95	126	1,250	6,368	1,245	810	2,609
1993/94																
Grilse	31,000	3,083	16,539	-	-	-	-	-	-	-	-	2,387	14,152	3,410	-	8,058
Lg. salmon	4,500	450	2,742	126	95	95	63	63	63	95	126	441	1,575	90	810	408
Total	35,500	3,533	19,281	126	95	95	63	63	63	95	126	2,828	15,727	3,500	810	8,466
1994/00																
Grilse	31,000	3,083	16,539	-	-	-	-	-	-	-	-	2,387	14,152	3,410	-	8,058
Lg salmon	9,000	900	5,481	252	189	189	126	126	126	189	252	882	3,150	180	1,620	819
Total	40,000	3,983	22,020	252	189	189	126	126	126	189	252	3,269	17,302	3,590	1,620	8,877
2000/01																
Grilse	43,050	6,218	22,968	-	-	-	-	-	-	-	-	3,315	19,653	4,736	-	9,128
Lg salmon	9,000	900	5,481	252	189	189	126	126	126	189	252	882	3,150	180	1,620	819
Total	52,050	7,118	28,449	252	189	189	126	126	126	189	252	4,197	22,803	4,916	1,620	9,947
2001/05																
Grilse	43,050	6,218	22,968	-	-	-	-	-	-	-	-	3,315	19,653	4,736	-	9,128
Lg salmon	18,450	1,845	11,238	517	388	388	258	258	258	388	517	1,808	6,458	369	3,321	1,677
Total	61,500	8,063	34,206	517	388	388	258	258	258	388	517	5,123	26,111	5,105	3,321	10,805
2005/06																
Grilse	63,560	12,488	33,909	-	-	-	-	-	-	-	-	4,894	29,015	6,992	-	10,171
Lg salmon	18,450	1,845	11,238	517	388	388	258	258	258	388	517	1,808	6,458	369	3,321	1,677
Total	82,010	14,333	45,147	517	388	388	258	258	258	388	517	6,702	35,473	7,361	3,321	11,848
2006/07, etc.																
Grilse	63,560	12,488	33,909	-	-	-	-	-	-	-	-	4,894	29,015	6,992	-	10,171
Lg salmon	27,240	2,724	16,589	763	572	572	381	381	381	572	763	2,670	9,534	545	4,903	2,479
Total	90,800	15,212	50,498	763	572	572	381	381	381	572	763	7,564	38,549	7,537	4,903	12,650

Table 14. Allocation and utilization of Atlantic salmon by weight (kg) for Robinsons River and satellites. Based on 1980 fishing plan. Pond ranching project.

Lg salmon	Production	Brood	Tot. coastal harvest	Harvest by Statistical Area										Recreational	West Greenland	Additional harvest
				A	B	C	D	E	F	H	I	J	K			
1988/89																
Grilse	20,601	2,313	11,550	-	-	-	-	-	-	-	-	2,310	9,240	3,696	-	3,042
Total	20,601	2,313	11,550	-	-	-	-	-	-	-	-	2,310	9,240	3,696	-	3,042
1989/93																
Grilse	20,601	2,313	11,550	-	-	-	-	-	-	-	-	2,310	9,240	3,696	-	3,042
Lg salmon	14,400	1,440	10,080	506	506	506	506	506	506	506	506	2,016	4,032	288	2,592	-
Total	35,001	3,753	21,630	506	506	506	506	506	506	506	506	4,326	13,272	3,984	2,592	3,042
1993/94																
Grilse	55,026	4,625	34,100	-	-	-	-	-	-	-	-	6,820	27,280	5,115	-	11,186
Lg salmon	14,400	1,440	10,080	506	506	506	506	506	506	506	506	2,016	4,032	288	2,592	-
Total	69,426	6,065	44,180	506	506	506	506	506	506	506	506	8,836	31,312	5,403	2,592	11,186
1994/00																
Grilse	55,026	4,625	34,100	-	-	-	-	-	-	-	-	6,820	27,280	5,115	-	11,186
Lg salmon	28,800	2,880	20,160	1,008	1,008	1,008	1,008	1,008	1,008	1,008	1,008	4,032	8,064	576	5,184	-
Total	83,826	7,505	54,260	1,008	1,008	1,008	1,008	1,008	1,008	1,008	1,008	10,852	35,344	5,691	5,184	11,186
2000/01																
Grilse	76,414	9,327	47,356	-	-	-	-	-	-	-	-	9,471	37,885	7,104	-	12,627
Lg salmon	28,800	2,880	20,160	1,008	1,008	1,008	1,008	1,008	1,008	1,008	1,008	4,032	8,064	576	5,184	-
Total	105,214	12,207	67,516	1,008	1,008	1,008	1,008	1,008	1,008	1,008	1,008	13,503	45,949	7,680	5,184	12,627
2001/05																
Grilse	76,414	9,327	47,356	-	-	-	-	-	-	-	-	9,471	37,885	7,104	-	12,627
Lg salmon	59,040	5,904	41,328	2,067	2,067	2,067	2,067	2,067	2,067	2,067	2,067	8,266	16,531	1,181	10,627	-
Total	135,454	15,231	88,684	2,067	2,067	2,067	2,067	2,067	2,067	2,067	2,067	17,737	54,416	8,285	10,627	12,627
2005/06																
Grilse	112,819	18,732	69,916	-	-	-	-	-	-	-	-	13,983	55,933	10,488	-	13,683
Lg salmon	59,040	5,904	41,328	2,067	2,067	2,067	2,067	2,067	2,067	2,067	2,067	8,266	16,531	1,181	10,627	-
Total	171,859	24,636	111,244	2,067	2,067	2,067	2,067	2,067	2,067	2,067	2,067	22,249	72,464	11,669	10,627	13,683
2006/07, etc.																
Grilse	112,819	18,732	69,916	-	-	-	-	-	-	-	-	13,983	55,933	10,488	-	13,683
Lg salmon	87,168	8,717	61,018	3,050	3,050	3,050	3,050	3,050	3,050	3,050	3,050	12,205	24,406	1,744	15,690	-
Total	199,987	27,449	130,934	3,050	3,050	3,050	3,050	3,050	3,050	3,050	3,050	26,188	80,339	12,232	15,690	13,683

Table 15. Allocation and utilization of Atlantic salmon by weight (kg) for Robinsons River and satellites. Based on a fishing plan to reduce interception of non-Newfoundland/Labrador salmon by 25%. Pond ranching project.

Lg salmon	Production	Brood	Tot. coastal harvest	Harvest by Statistical Area										Recreational	West Greenland	Additional harvest
				A	B	C	D	E	F	H	I	J	K			
1988/89																
Grilse	20,601	2,313	11,204	-	-	-	-	-	-	-	-	1,618	9,586	3,696	-	3,388
Total	20,601	2,313	11,204	-	-	-	-	-	-	-	-	1,618	9,586	3,696	-	3,388
1989/93																
Grilse	20,601	2,313	11,204	-	-	-	-	-	-	-	-	1,618	9,586	3,696	-	3,388
Lg salmon	14,400	1,440	8,775	403	304	304	202	202	202	304	403	1,411	5,040	288	2,592	1,305
Total	35,001	3,753	19,979	403	304	304	202	202	202	304	403	3,029	14,626	3,984	2,592	4,693
1993/94																
Grilse	55,026	4,625	33,077	-	-	-	-	-	-	-	-	4,774	28,303	5,115	-	12,209
Lg salmon	14,400	1,440	8,775	403	304	304	202	202	202	304	403	1,411	5,040	288	2,592	1,305
Total	69,426	6,065	41,852	403	304	304	202	202	202	304	403	6,185	33,343	5,403	2,592	13,514
1994/00																
Grilse	55,026	4,625	33,077	-	-	-	-	-	-	-	-	4,774	28,303	5,115	-	12,209
Lg salmon	28,800	2,880	17,538	806	605	605	403	403	403	605	806	2,822	10,080	576	5,184	2,622
Total	83,826	7,505	50,615	806	605	605	403	403	403	605	806	7,596	38,383	5,691	5,184	14,831
2000/01																
Grilse	76,414	9,327	45,936	-	-	-	-	-	-	-	-	6,630	39,306	7,104	-	14,049
Lg salmon	28,800	2,880	17,538	806	605	605	403	403	403	605	806	2,822	10,080	576	5,184	2,622
Total	105,214	12,207	63,474	806	605	605	403	403	403	605	806	9,452	49,386	7,680	5,184	16,669
2001/05																
Grilse	76,414	9,327	45,936	-	-	-	-	-	-	-	-	6,630	39,306	7,104	-	14,047
Lg salmon	59,040	5,904	35,964	1,654	1,242	1,242	826	826	826	1,242	1,654	5,786	20,666	1,181	10,627	5,366
Total	135,454	15,231	81,900	1,654	1,242	1,242	826	826	826	1,242	1,654	12,416	59,972	8,285	10,627	19,413
2005/06																
Grilse	112,819	18,732	67,818	-	-	-	-	-	-	-	-	9,788	58,030	10,488	-	15,781
Lg salmon	59,040	5,904	35,964	1,654	1,242	1,242	826	826	826	1,242	1,654	5,786	20,666	1,181	10,627	5,366
Total	171,859	24,636	103,782	1,654	1,242	1,242	826	826	826	1,242	1,654	15,574	78,696	11,669	10,627	21,147
2006/07, etc.																
Grilse	112,819	18,732	67,818	-	-	-	-	-	-	-	-	9,788	58,030	10,488	-	15,781
Lg salmon	87,168	8,717	53,085	2,442	1,830	1,830	1,219	1,219	1,219	1,830	2,442	8,544	30,509	1,744	15,690	7,933
Total	199,987	27,449	120,903	2,442	1,830	1,830	1,219	1,219	1,219	1,B30	2,442	18,332	88,539	12,232	15,690	23,714

Indian Bay Brook

Indian Bay Brook

This system and its satellite Ragged Harbour River have a pond ranching production potential of 53,000 adults annually (37,100 grilse and 15,900 large salmon). An incubation facility will be built at Indian Bay Brook in 1984/85 at a capital cost of $440,000 and expanded in 1995/96 (in order to bring on the satellite) at an additional cost of $110,000. Ragged Harbour River brood will be held and stripped at that river and green eggs transported to Indian Bay Brook for incubation with subsequent stocking back of fry. First grilse for the Indian Bay Brook phase alone will accrue in 1989/90 with large salmon in 1990/91; first grilse for the expanded phase will appear in 2000/01 and large salmon one year later.

Cost and labour flows are shown in Table 1 and production and harvest allocation for the two fishing plans in Tables 16 and 17 respectively.

Table 16. Allocation and utilization of Atlantic salmon by number and by weight for Indian Bay Brook and satellite. Based on 1980 fishing plan. Pond ranching project.

	Production		Brood		Tot. coastal		Harvest by Statistical Area										Recreational		West Greenland		Additional harvest	
							A		B		C		D		E							
	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg
1989/90																						
Grilse	14,700	26,093	1,390	2,085	8,085	16,170	-	-	1,213	2,426	5,255	10,510	1,213	2,426	404	808	1,617	2,426	-	-	3,608	5,412
Total	14,700	26,093	1,390	2,085	8,085	16,170	-	-	1,213	2,426	5,255	10,510	1,213	2,426	404	808	1,617	2,426	-	-	3,608	5,412
1990/00																						
Grilse	14,700	26,093	1,390	2,085	8,085	16,170	-	-	1,213	2,426	5,255	10,510	1,213	2,426	404	808	1,617	2,426	-	-	3,608	5,412
Lg salmon	6,300	20,160	630	2,016	4,410	14,112	221	707	882	2,822	2,205	7,056	882	2,822	221	707	126	403	1,134	3,629	-	-
Total	21,000	46,253	2,020	4,101	12,495	30,282	221	707	2,095	5,248	7,460	17,566	2,095	5,248	625	1,515	1,743	2,829	1,134	3,629	3,608	5,412
2000/01																						
Grilse	37,100	65,853	2,330	3,495	20,405	40,810	-	-	3,061	6,122	13,263	26,526	3,061	6,122	1,020	2,040	4,081	6,122	-	-	10,284	15,426
Lg salmon	6,300	20,160	630	2,016	4,410	14,112	221	707	882	2,822	2,205	7,056	882	2,822	221	707	126	403	1,134	3,629	-	-
Total	43,400	86,013	2,960	5,511	24,815	54,922	221	707	3,943	8,944	15,468	33,582	3,943	8,944	1,241	2,747	4,207	6,525	1,134	3,629	10,284	15,426
2001/02																						
Grilse	37,100	65,853	2,330	3,495	20,405	40,810	-	-	3,061	6,122	13,263	26,526	3,061	6,122	1,020	2,040	4,081	6,122	-	-	10,284	15,426
Lg salmon	15,900	50,880	1,590	5,088	11,130	35,616	557	1,782	2,226	7,123	5,565	17,808	2,226	7,123	557	1,782	318	1,018	2,862	9,158	-	-
Total	53,000	116,733	3,920	8,583	31,535	76,426	557	1,782	5,287	13,245	18,828	44,334	5,287	13,245	1,577	3,822	4,399	7,140	2,862	9,158	10,284	15,426

Table 17. Allocation and utilization of Atlantic salmon by number and by weight for Indian Bay Brook and satellite. Based on a fishing plan to reduce interception of non-Newfoundland/Labrador salmon by 25%. Pond ranching project.

	Production		Brood		Tot. coastal		Harvest by Statistical Area															
							A		B		C		D		E		Recreational		West Greenland		Additional harvest	
	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg
1989/90																						
Grilse	14,700	26,093	1,390	2,085	6,064	12,128	-	-	889	1,778	4,043	8,086	889	1,778	243	486	1,617	2,426	-	-	5,629	9,454
Total	14,700	26,093	1,390	2,085	6,064	12,128	-	-	889	1,778	4,043	8,086	889	1,778	243	486	1,617	2,426	-	-	5,629	9,454
1990/00																						
Grilse	14,700	26,093	1,390	2,085	6,064	12,128	-	-	889	1,778	4,043	8,086	889	1,778	243	486	1,617	2,426	-	-	5,629	9,454
Lg salmon	6,300	20,160	630	2,016	3,042	9,734	176	563	617	1,974	1,544	4,941	617	1,974	88	282	126	403	1,134	3,629	1,368	4,378
Total	21,000	46,253	2,020	4,101	9,106	21,862	176	563	1,506	3,752	5,587	13,027	1,506	3,752	331	768	1,743	2,829	1,134	3,629	6,997	13,832
2000/01																						
Grilse	37,100	65,853	2,330	3,495	15,305	30,610	-	-	2,245	4,490	10,203	20,406	2,245	4,490	612	1,224	4,081	6,122	-	-	15,384	25,626
Lg salmon	6,300	20,160	630	2,016	3,042	9,734	176	563	617	1,974	1,544	4,941	617	1,974	88	282	126	403	1,134	3,629	1,368	4,378
Total	43,400	86,013	2,960	5,511	18,347	40,344	176	563	2,862	6,464	11,747	25,347	2,862	6,464	700	1,506	4,207	6,525	1,134	3,629	16,752	30,004
2001/02, etc.																						
Grilse	37,100	65,853	2,330	3,495	15,305	30,610	-	-	2,245	4,490	10,203	20,406	2,245	4,490	612	1,224	4,081	6,122	-	-	15,384	25,626
Lg salmon	15,900	50,880	1,590	5,088	7,680	24,576	445	1,424	1,558	4,986	3,896	12,467	1,558	4,986	223	714	318	1,018	2,862	9,158	3,450	11,040
Total	53,000	116,733	3,920	8,583	22,985	55,186	445	1,424	3,803	9,476	14,099	32,873	3,803	9,476	835	1,938	4,399	7,140	2,862	9,158	18,834	36,666

Gander Bay Brook

Gander Bay Brook

This river has an annual pond ranching potential of 98,200 adults (68,740 grilse and 29,460 large salmon). An incubation facility will be constructed in 1985/86 at a capital cost of $550,000. First grilse will appear in 1990/91 and first large salmon one year later.

Cost and labour flows are shown in Table 1; production and harvest allocation under the two fishing plans are presented in Tables 18 and 19.

Table 18. Allocation and utilization of Atlantic salmon by number and by weight for Gander Bay Brook. Based on 1980 fishing plan. Pond ranching project.

	Production		Brood		Tot. coastal		Harvest by Statistical Area										Recreational		West Greenland		Additional harvest	
							A		B		C		D		E							
	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg
1990/91																						
Grilse	68,740	122,014	4,890	7,335	37,807	75,614	7,561	15,122	24,575	49,150	3,781	7,562	1,890	3,780	-	-	7,561	11,342	-	-	18,482	27,723
Total	68,740	122,014	4,890	7,335	37,807	75,614	7,561	15,122	24,575	49,150	3,781	7,562	1,890	3,780	-	-	7,561	11,342	-	-	18,482	27,723
1991/92, etc.																						
Grilse	68,740	122,014	4,890	7,335	37,807	75,614	7,561	15,122	24,575	49,150	3,781	7,562	1,890	3,780	-	-	7,561	11,342	-	-	18,482	27,723
Lg salmon	29,460	94,272	2,946	9,427	20,622	65,987	4,124	13,197	9,280	29,696	4,124	13,197	2,062	6,598	1,031	3,299	589	1,885	5,303	16,970	-	-
Total	98,200	216,286	7,836	16,672	58,429	141,601	11,685	28,319	33,855	78,846	7,905	20,759	3,952	10,378	1,031	3,299	8,150	13,227	5,303	16,970	18,482	27,723

Table 19. Allocation and utilization of Atlantic salmon by number and by weight for Gander Bay Brook. Based on a fishing plan to reduce interception of non-Newfoundland/Labrador salmon by 25%. Pond ranching project.

	Production		Brood		Tot. coastal		Harvest by Statistical Area										Recreational		West Greenland		Additional harvest	
							A		B		C		D		E							
	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg
1990/91																						
Grilse	68,740	122,014	4,890	7,335	29,112	58,224	6,049	12,098	18,904	37,808	2,647	5,294	1,512	3,024	-	-	7,561	11,342	-	-	27,177	40,766
Total	68,740	122,014	4,890	7,335	29,112	58,224	6,049	12,098	18,904	37,808	2,647	5,294	1,512	3,024	-	-	7,561	11,342	-	-	27,177	40,766
1991/92, etc.																						
Grilse	68,740	122,014	4,890	7,335	29,112	58,224	6,049	12,098	18,904	37,808	2,647	5,294	1,512	3,024	-	-	7,561	11,342	-	-	27,177	40,766
Lg salmon	29,460	94,272	2,946	9,427	15,054	48,173	3,299	10,557	7,218	23,098	2,681	8,579	1,444	4,621	412	1,318	589	1,885	5,303	16,970	5,568	17,818
Total	98,200	216,286	7,836	16,672	44,166	106,397	9,348	22,655	26,122	60,906	5,328	13,873	2,956	7,645	412	1,318	8,150	13,227	5,303	16,970	32,745	58,584

Torrent River and Satellites

Torrent River and Satellites

Torrent River and its satellites (East Brook, River of Ponds, Little Brook Ponds, Cloud River, Northwest Brook and Castors River) have a combined pond ranching production potential up to 56,700 adults annually (39,690 grilse and 17,010 large salmon). This estimate assumes that salmon currently are not using standing waters for rearing. An incubation facility to accommodate stocking could be built on Torrent River in 1986/87 at a cost of $550,000. First grilse should appear in 1991/92 and large salmon in 1992/93.

Cost and labour flows are presented in Table 1; production and harvest allocation under the two fishing plans are given in Tables 20 and 21.

Table 20. Allocation and utilization of Atlantic salmon by number and by weight for Torrent River and satellites. Based on 1980 fishing plan. Pond ranching project.

	Production		Brood		Tot. coastal		Harvest by Statistical Area												Recreational		West Greenland		Additional harvest	
							A		B		C		D		M		N							
	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg
1991/92																								
Grilse	39,690	70,451	2,896	4,344	21,830	43,660	2,183	4,366	-	-	-	-	-	-	13,098	26,196	6,549	13,098	4,365	6,548	-	-	10,599	15,895
Total	39,690	70,451	2,896	4,344	21,830	43,660	2,183	4,366	-	-	-	-	-	-	13,098	26,196	6,549	13,098	4,365	6,548	-	-	10,599	15,895
1992/93, etc.																								
Grilse	39,690	70,451	2,896	4,344	21,830	43,660	2,183	4,366	-	-	-	-	-	-	13,098	26,196	6,549	13,098	4,365	6,548	-	-	10,599	15,895
Lg salmon	17,010	54,432	1,701	54,432	11,907	38,098	2,977	9,526	1,786	5,715	595	1,904	595	1,904	3,572	11,430	2,381	7,619	340	1,086	3,062	9,798	-	-
Total	56,700	124,883	4,597	58,776	33,737	81,758	5,160	13,982	1,786	5,715	595	1,904	595	1,904	16,673	37,626	8,930	20,717	4,705	7,636	3,062	9,798	10,599	15,895

Table 21. Allocation and utilization of Atlantic salmon by number and by weight for Torrent River and satellites. Based on a fishing plan to reduce interception of non-Newfoundland/Labrador salmon by 25%. Pond ranching project.

	Production		Brood		Tot. coastal		Harvest by Statistical Area												Recreational		West Greenland		Additional harvest	
							A		B		C		D		M		N							
	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg
1991/92																								
Grilse	39,690	70,451	2,896	4,344	21,829	43,658	1,746	3,492	-	-	-	-	-	-	13,316	26,632	6,767	13,534	4,365	6,548	-	-	10,600	15,900
Total	39,690	70,451	2,896	4,344	21,829	43,658	1,746	3,492	-	-	-	-	-	-	13,316	26,632	6,767	13,534	4,365	6,548	-	-	10,600	15,900
1992/93, etc.																								
Grilse	39,690	70,451	2,896	4,344	21,829	43,658	1,746	3,492	-	-	-	-	-	-	13,316	26,632	6,767	13,534	4,365	6,548	-	-	10,600	15,900
Lg salmon	17,010	54,432	1,701	54,432	11,193	35,817	2,381	7,619	1,310	4,192	357	1,142	-	-	4,168	13,328	2,977	9,526	340	1,086	3,062	9,798	714	2,285
Total	56,700	124,883	4,597	58,776	33,022	79,475	4,127	11,111	1,310	4,192	357	1,142	-	-	17,484	39,970	9,744	23,060	4,705	7,636	3,062	9,798	11,314	18,185

South Brook

South Brook

Total pond ranching potential of this river is 22,100 adults annually (15,470 grilse and 6,630 large salmon). An incubation facility will be constructed in 1986/87 at a cost of $495,000. First grilse will appear in 1991/92 and large salmon a year later.

Cost and labour flows are shown in Table 1. Production and harvest allocation under the two fishing plans are given in Tables 22 and 23.

Table 22. Allocation and utilization of Atlantic salmon by number and by weight for South Brook. Based on 1980 fishing plan. Pond ranching project.

	Production		Brood		Tot. coastal		Harvest by Statistical Area										Recreational		West Greenland		Additional harvest	
							A		B		C		D		E							
	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg
1991/92																						
Grilse	7,630	13,540	543	815	4,197	8,394	839	1,678	2,728	5,456	420	840	210	420	-	-	839	1,259	-	-	2,051	3,07
Total	7,630	13,540	543	815	4,197	8,394	839	1,678	2,728	5,456	420	840	210	420	-	-	839	1,259	-	-	2,051	3,07
1992/93																						
Grilse	15,470	27,459	1,100	1,650	8,508	17,016	1,702	3,404	5,530	11,060	851	1,702	425	850	-	-	1,702	2,553	-	-	4,160	6,24
Lg salmon	3,270	10,468	327	1,046	2,289	7,329	458	1,466	1,030	3,296	458	1,466	229	773	115	368	65	208	589	1,885	-	
Total	18,740	37,927	1,427	2,696	10,797	24,345	2,160	4,870	6,560	14,358	1,309	3,168	654	1,583	115	368	1,767	2,761	589	1,885	4,160	6,24
1993/94, etc.																						
Grilse	15,470	27,459	1,100	1,650	8,508	17,016	1,702	3,404	5,530	11,060	851	1,702	425	850	-	-	1,702	2,553	-	-	4,160	6,24
Lg salmon	6,630	21,216	663	2,122	4,641	14,852	928	2,970	2,089	6,685	928	2,970	464	1,485	232	742	133	426	1,193	3,818	-	
Total	22,100	48,675	1,763	3,772	13,149	31,868	2,630	6,374	7,619	17,745	1,779	4,672	889	2,335	232	742	1,835	2,979	1,193	3,818	4,160	6,24

Table 23. Allocation and utilization of Atlantic salmon by number and by weight for South Brook. Based on a fishing plan to reduce interception of non-Newfoundland/Labrador salmon by 25%. Pond ranching project.

	Production		Brood		Tot. coastal		Harvest by Statistical Area										Recreational		West Greenland		Estuarial harvest	
							A		B		C		D		E							
	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg	No.	kg
1991/92																						
Grilse	7,630	13,540	543	815	3,232	6,464	671	1,342	2,099	4,198	294	558	168	336	-	-	839	1,259	-	-	3,016	4,525
Total	7,630	13,540	543	815	3,232	6,464	671	1,342	2,099	4,198	294	588	168	336	-	-	839	1,259	-	-	3,016	4,525
1992/93																						
Grilse	15,470	27,459	1,100	1,650	6,551	13,102	1,361	2,722	4,254	8,508	596	1,192	340	680	-	-	1,702	2,553	-	-	6,117	9,176
Lg salmon	3,270	10,468	327	1,046	1,671	5,347	366	1,172	801	2,563	298	954	160	512	46	147	65	208	589	1,885	618	1,978
Total	18,740	37,927	1,427	2,696	8,222	18,449	1,727	3,893	5,055	11,071	894	2,146	500	1,192	46	147	1,767	2,761	589	1,885	6,735	11,154
1993/94, etc.																						
Grilse	15,470	27,459	1,100	1,650	6,551	13,102	1,361	2,722	4,254	8,508	596	1,192	340	680	-	-	1,702	2,553	-	-	6,117	9,176
Lg salmon	6,630	21,216	663	2,122	3,388	10,843	743	2,378	1,624	5,197	603	1,930	325	1,040	93	298	133	426	1,193	3,818	1,253	4,010
Total	22,100	48,675	1,763	3,722	9,939	23,945	2,104	5,100	5,878	13,705	1,199	3,122	665	1,720	93	298	1,835	2,979	1,193	3,818	7,370	13,186

(c) Summary Table 24: Cost and Person-Year Flows for Colonization and Pond Ranching Projects.

Cost and Production Flows for all Colonization and Pond Ranching Projects Combined

The combined capital, O/M and labour cost flows (also number of PY's for the ten colonization and pond ranching projects plus the Grand Total Cost flow are shown in Table 24. Combined production and harvest allocations for all project are shown in Tables 25 and 26 for the two respective fishing plans. Cost and production data for all projects combined are summarized in Fig. 2 (Page P-16-a).

Bio-Engineering Activities and Associated Cost/Labour Flows Per Project

The different bio-engineering activities and criteria used to develop the total cost flow for each project are presented in Tables 27-36.

Table 1. Combined cost and labour flows for a mix of 10 colonization/pond ranching projects for the Newfoundland/Labrador Atlantic Salmon enhancement program.

Year	Capital (1981 $ X 1000)	O/M (1981 $ X 1000)	PY			
			Permanent		Other	
			No.	Cost ($ X 1000)	No.	Cost ($ X 1000)
1982/83	522.5	187.1	5.1	137.7	10.5	199.5
1983/84	556.6	249.2	5.8	156.6	11.6	220.4
1984/85	2147.2	314.1	7.7	207.9	15.8	300.2
1985/86	1196.8	370.4	9.1	245.7	21.3	404.7
1986/87	2420.0	405.7	7.3	197.1	18.8	357.2
1987/88	440.0	478.0	8.4	226.8	22.9	435.1
1988/89	825.0	358.1	8.4	226.8	20.2	383.8
1989/90	1045.0	358.1	8.4	226.8	20.2	383.8
1990/91	-	339.4	7.0	189.0	21.9	416.1
1991/95	-	283.3	6.6	178.2	18.6	353.4
1995/96	550.0	292.1	8.6	232.2	20.2	383.8
1996/97, etc.	-	292.1	8.6	232.2	20.2	383.8

Table 25. Combined allocation and utilization by weight and number (in parentheses) of Atlantic salmon resulting from a mix of 10 pond ranching and colonization projects. Based on 1980 fishing plan.

Statistical area	'86/87	'87/88	'88/89	'89/90	'90/91	'91/92	'92/93	'93/94	'94/00	'00/01	'01/05	'05/06	'06/07 etc
A	5,400	10,200	10,200	11,606	36,035	74,096	89,484	93,188	93,690	93,690	95,824	95,824	96,807
B	17,800	32,000	32,800	37,332	113,504	165,956	189,353	199,760	200,262	203,958	209,318	209,318	210,301
C	2,800	6,800	10,600	24,416	42,634	63,071	68,503	71,007	71,509	87,525	99,336	99,336	100,319
D	1,400	3,300	4,100	8,632	17,034	27,252	31,119	32,271	32,773	36,469	41,829	41,829	42,812
E		600	800	3,014	3,721	8,620	8,988	9,362	9,864	11,096	13,230	13,230	14,213
F				1,106	1,106	1,106	1,106	1,106	1,608	1,608	2,667	2,667	3,650
H				1,106	1,106	1,106	1,106	1,106	1,608	1,608	2,667	2,667	3,650
I				1,106	1,106	1,106	1,106	1,106	1,608	1,608	2,667	2,667	3,650
J			3,610	7,326	7,326	7,326	7,326	11,836	13,852	16,503	20,737	25,249	29,188
K			11,840	18,072	18,072	18,072	18,072	36,112	40,144	50,749	59,216	77,264	85,139
L			9,300	12,100	12,100	12,100	12,100	12,100	12,100	12,100	12,100	12,100	12,100
M						26,196	37,626	37,626	37,626	37,626	37,626	37,626	37,626
N						13,098	20,717	20,717	20,717	20,717	20,717	20,717	20,717
O					9,800	55,800	55,800	55,800	55,800	55,800	55,800	55,800	55,800
Total Coastal	27,400	52,900	83,250	125,816	263,544	474,885	542,406	583,097	593,161	631,057	673,734	696,294	715,972
Har.	(13,700)	(24,100)	(39,275)	(55,610)	(121,827)	(192,776)	(217,883)	(236,910)	(240,060)	(259,008)	(272,343)	(283,623)	(289,776)
Recreational	4,500	7,300	14,096	17,410	36,055	47,547	52,537	56,374	56,662	62,347	63,567	66,951	67,514
Har.	(3,000)	(4,700)	(7,855)	(9,672)	(22,949)	(29,242)	(32,110)	(35,833)	(35,923)	(39,713)	(40,094)	(42,350)	(42,526)
Additional	4,400	8,800	11,842	17,238	44,959	64,026	72,524	85,648	85,664	97,119	97,114	98,170	98,181
Har.	(2,900)	(5,800)	(7,828)	(11,436)	(29,648)	(42,568)	(48,477)	(57,106)	(57,106)	(64,743)	(64,743)	(65,447)	(65,447)
Spawners	4,500	6,000	16,913	22,638	65,489	101,585	108,909	112,297	113,737	119,849	125,945	135,350	138,163
	(3,000)	(3,900)	(11,142)	(13,682)	(40,502)	(52,387)	(54,972)	(56,849)	(57,299)	(61,374)	(63,279)	(69,549)	(70,428)
West	-	3,200	3,200	9,992	13,621	55,691	67,374	69,307	71,899	71,899	82,871	82,871	87,934
Greenland	-	(1,000)	(1,000)	(3,110)	(4,244)	(17,347)	(20,998)	(21,602)	(22,412)	(22,412)	(25,841)	(25,841)	(27,423)
Total	40,800	78,200	129,301	193,094	423,668	743,734	843,750	906,723	921,123	982,271	1,043,231	1,079,636	1,107,764
Production	(22,600)	(39,500)	(67,100)	(93,600)	(219,170)	(334,320)	(374,440)	(408,300)	(412,800)	(447,250)	(466,300)	(486,810)	(495,600)

Table 26. Combined allocation and utilization by weight and number (in parentheses) of Atlantic salmon resulting from a mix of 10 pond ranching and colonization projects. Based on a fishing plan to reduce the harvest of non-Newfoundland and Labrador salmon by 25%.

Statistical area	'86/87	'87/88	'88/89	'89/90	'90/91	'91/92	'92/93	'93/94	'94/00	'00/01	'01/05	'05/06	'06/07 etc
A	4,200	8,100	8,100	9,253	28,914	59,305	71,675	74,332	75,185	75,185	76,894	76,894	77,682
B	13,800	24,700	25,300	28,332	84,714	127,210	144,575	152,709	153,010	155,722	159,371	159,371	159,959
C	2,000	4,600	7,400	17,740	30,575	43,942	47,442	49,128	49,519	61,839	70,002	70,002	70,590
D	1,200	2,800	3,400	6,280	12,678	19,835	21,091	22,019	22,220	24,932	28,367	28,367	28,760
E		300	500	1,388	1,670	3,688	3,835	3,986	4,187	4,925	5,780	5,780	6,173
F				402	402	402	402	402	603	603	1,026	1,026	1,419
H				654	654	654	654	654	955	955	1,592	1,592	2,180
I				853	853	853	853	853	1,256	1,256	2,104	2,104	2,892
J			2,518	5,229	5,229	5,229	5,229	8,385	9,796	11,652	14,616	17,774	20,532
K			12,386	20,326	20,326	20,326	20,326	39,043	44,083	55,086	65,672	84,396	94,239
L			9,500	13,550	13,550	13,550	13,550	13,550	13,550	13,550	13,550	13,550	13,550
M						26,632	39,970	39,970	39,970	39,970	39,970	39,970	39,970
N						13,534	23,060	23,060	23,060	23,060	23,060	23,060	23,060
O					7,000	57,700	57,700	57,700	57,700	57,700	57,700	57,700	57,700
Total Coastal	21,200	40,500	69,104	104,007	199,565	392,860	450,362	485,791	495,094	526,435	559,704	581,586	598,706
Har.	(10,600)	(18,500)	(32,802)	(45,988)	(97,942)	(159,257)	(180,340)	(197,194)	(199,933)	(215,603)	(225,998)	(236,939)	(242,290)
Recreational	4,500	7,300	14,096	17,410	36,055	47,547	52,537	56,374	56,662	62,347	63,567	66,951	67,514
Har.	(3,000)	(4,700)	(7,855)	(9,762)	(22,949)	(29,242)	(32,110)	(35,833)	(35,923)	(39,713)	(40,094)	(42,350)	(42,526)
Additional	7,200	14,300	19,088	32,147	93,838	122,351	140,868	159,254	160,031	178,041	187,444	189,178	191,747
Har.	(4,300)	(8,600)	(11,501)	(18,258)	(46,933)	(66,487)	(76,420)	(87,222)	(87,633)	(98,548)	(101,488)	(102,531)	(103,333)
Estuarial *	3,400	6,900	6,900	6,900	15,100	23,700	23,700	23,700	23,700	23,700	23,700	23,700	23,700
Har.	(1,700)	(2,800)	(2,800)	(2,800)	(6,600)	(9,600)	(9,600)	(9,600)	(9,600)	(9,600)	(9,600)	(9,600)	(9,600)
Spawners	4,500	6,000	16,913	22,638	65,489	101,585	108,909	112,297	113,737	119,849	125,945	135,350	138,163
	(3,000)	(3,900)	(11,142)	(13,682)	(40,502)	(52,387)	(54,972)	(56,849)	(57,299)	(61,374)	(63,279)	(69,549)	(70,428)
West	-	3,200	3,200	9,992	13,621	55,691	67,374	69,307	71,899	71,899	82,871	82,871	87,934
Greenland	-	(1,000)	(1,000)	(3,110)	(4,244)	(17,347)	(20,998)	(21,602)	(22,412)	(22,412)	(25,841)	(25,841)	(27,423)
Total	40,800	78,200	129,301	193,094	423,668	743,734	843,750	906,723	921,123	982,271	1,043,231	1,079,636	1,107,764
Production	(22,600)	(39,500)	(67,100)	(93,600)	(219,170)	(334,320)	(374,440)	(408,300)	(412,800)	(447,250)	(466,300)	(486,810)	(495,600)

* Exploits River only

(d) Detailed Cost/Person-Year Flow Sheets of Bioengneering Activity For Preliminary Implementation and Operational Phases of Colonization and Pond Ranching Projects.

Table 27 Activity, Cost ($ x 1,000) and Labour Flows

Key: Biology (engineering). Note: Labour costs not included in O/M.

Exploits Activity Overall-Revised	1982/83				1983/84				84/85			
		PM (No.)				PM (No.)				PM (No.)		
	Capital ($)	Permanent	Other	O/M ($)	Capital ($)	Permanent	Other	O/M ($)	Capital ($)	Permanent	Other	O/M ($)
Preliminary Baseline Investigation		(a) 3	a 6	a 11								
Site Surveys						a (2)	a (2)	a (2.2)		a (2)	a (2)	a (2.2)
Feasibility/ Manageability Studies		b 24	b 18	b 33		b 24	b 18	b 33	c 11	b 24 c 24	b 18 c 8	b 33 c 39.6
Conceptual Design												
Land Acquisition												
Final Design									f (55)			
Construction												
Operation	c 8.8		d 30	d 35.2			d 30	d 35.2			d 30	d 35.2
Annual Assessment (Evaluation)						e 3	e 8	e 9.9		e 3	e 8	e 9.9
Harvest/Protection												
Maintenance			(8)	(18.15)			(8)	(18.15)			(8)	(18.15)
Totals	8.8	27	54(8)	79.2(18.15		27.2	56(10)	78.1(20.35	11 (55)	51 (2)	64 (10)	117.7(20.

a Bio-baselines studies of all upper watershed tributaries

b Estuarial Harvest

c New Helicopter Frytransfer system and fry counter.

d Noel Paul Operation

a Site surveys on Noel Paul and Grand Falls Fishway.

b Estuarial Harvest

c Final design Grand Falls Fishway

d Noel Paul Operation

e Assessment of all tributaries in upper watershed.

a Site survey - Red Indian Dam

b Estuarial Harvest

c Smolt assessment on LLoyds and radio tracking of smolt through Red Indian Lake.

d Noel Paul Operation

e Assessment of all tributaries in upper watershed.

f Grand Falls Fishway Design.

Table 27 Continued

Key: Biology (engineering). Note: Labour costs not included in O/M.

Exploits Activity Overall (Revised)	85/86				86/87				87/88			
		PM (No.)				PM (No.)				PM (No.)		
	Capital ($)	Permanent	Other	O/M ($)	Capital ($)	Permanent	Other	O/M ($)	Capital ($)	Permanent	Other	O/M ($)
Preliminary Baseline Investigation												
Site Surveys												
Feasibility/ Manageability Studies			[a] 18	[a] 33		[a] 24	[a] 18	[a] 33		[a] 24	[a] 18	[a] 33
Conceptual Design												
Land Acquisition												
Final Design		[b] (6)		[b] (1.1)								
Construction	[c] (616)	[c] (10)	[c] (25)		[c] (880)				[b] (440)			
Operation			[d] 30	[d] 35.2			[c] 48	[c] 59.4			[c] 48	[c] 59.4
Annual Assessment (Evaluation)		[e] 3	[e] 8	[e] 9.9							[d] 4	[d] 1.1
Harvest/Protection							3	1.1			9	3.3
Maintenance			(8)	(18.15)			(8)	(18.15)			(8)	(18.15)
Totals	(616)	3 (16)	56 (33)	78.1 (19.25)	(880)	24	69 (8)	93.5 (18.15)	(440)	24	79 (8)	96.8 (18

[a] Estuarial Harvest

[b] Red Indian elevator

[c] Grand Falls Fishway (495); Noel Paul (121)

[d] Noel Paul Operation

[e] Assessment of all upper watershed tributaries

a) Estuarial Harvest

b) Phase 1 of Red Indian elevation system

c) Exnanded Noel Paul Operation

a) Estuarial Harvest

b) Phase 2 of Red Indian elevation system.

c) Expanded Noel Paul operation

d) Adult tracking through Red Indian Lak

Table 27 Continued

Key: Biology (engineering). Note: Labour costs not included in O/M.

Exploits overall Activity Revised	88/89				89/90				90/91			
		PM (No.)				PM (No.)				PM (No.)		
	Capital ($)	Permanent	Other	O/M ($)	Capital ($)	Permanent	Other	O/M ($)	Capital ($)	Permanent	Other	O/M ($)
Preliminary Baseline Investigation												
Site Surveys												
Feasibility/ Manageability Studies		[a]24	[a]18	[a]33		[a]24	[a]18	[a]33		[a]24	[a]18	[a]33
Conceptual Design												
Land Acquisition												
Final Design												
Construction												
Operation			[b]48	[b]59.4			[b]48	[b]59.4			[b]48	[b]59.4
Annual Assessment (Evaluation)												
Harvest/Protection			9	3.3			9	3.3			9	3.3
Maintenance			(8)	(18.15)			8	(18.15)			(11)	(20.25)
Totals		24	75(8)	95.7(18.15)		24	75(8)	95.7(18.15)		24	75(11)	95.7(20.
	a) Estuarial Harvest				a + b as before				a + b as before			
	b) Expanded Noel Paul Operation and operation of Fish elevator											

Table 27 Continued

Key: Biology (engineering). Note: Labour costs not included in O/M.

Exploits Overall Activity Revised	1991/92											
		PM (No.)				PM (No.)				PM (No.)		
	Capital ($)	Permanent	Other	O/M ($)	Capital ($)	Permanent	Other	O/M ($)	Capital ($)	Permanent	Other	O/M ($)
Preliminary Baseline Investigation												
Site Surveys												
Feasibility/ Manageability Studies		24	18	33								
Conceptual Design												
Land Acquisition												
Final Design												
Construction												
Operation			[a]13	[a]4.4								
Annual Assessment (Evaluation)												
Harvest/Protection			9	3.3								
Maintenance			(10)	(20.35)								
Totals		24	40(10)	40.7(20.35)								

a) operation of Fish elevator

Table 28 Activity, cost ($ x 1,000) and labour flows Key: Biology (engineering). Note: Labour costs not included in O/M.

Number / Activity	82/83				83/84				84/85			
		PM (No.)				PM (No.)				PM (No.)		
	Capital ($)	Permanent	Other	O/M ($)	Capital ($)	Permanent	Other	O/M ($)	Capital ($)	Permanent	Other	O/M ($)
Preliminary Baseline Investigation		2(2)	2	2.2								
Site Surveys	(11)		(2)	(5.5)	1.1	(1)	(2)	(5.5)	1.1	(1)	(2)	(5)
Feasibility/ Manageability Studies	11*	5*	7*	16.5 *								
Conceptual Design												
Land Acquisition Mar. 84						(1)						
Final Design Mar. 85												
Construction												
Operation						5	8	33		5	8	33
Annual Assessment (Evaluation)												
Harvest/Protection												
Maintenance												
Totals	11(11)	7(2)	9(2)	18.7(5.5)	1.1	5(2)	33(5.5)	1.1		5(2)	8(2)	33(5.5)

* Aides Adult Assessment

Table 28 Continued

Key: Biology (engineering). Note: Labour costs not included in O/M.

Number (con'd) Activity	85/86				86/87				87/88			
		PM (No.)				PM (No.)				PM (No.)		
	Capital ($)	Permanent	Other	O/M ($)	Capital ($)	Permanent	Other	O/M ($)	Capital ($)	Permanent	Other	O/M ($)
Preliminary Baseline Investigation												
Site Surveys												
Feasibility/ Manageability Studies												
Conceptual Design												
Land Acquisition												
Final Design		(4)	(2)	(5.5)								
Construction					* 495							
Operation		5	8	33		5	8	33		5	8	33
Annual Assessment (Evaluation)												
Harvest/Protection											4	6.6
Maintenance										(1)	(3)	*9.9
Totals		5(4)	8(2)	33(5.5)	495	5	8	33		5(1)	12(3)	49.5

* Could be spread over 2 years, also includes road.

* 1986-87, 1981-92 After that $4,000 O/M

After 1987 1 Permanent and 2 terms.

Table 28 Continued

Key: Biology (engineering). Note: Labour costs not included in O/M.

Number (con'd) Activity	88/89				89/90							
		PM (No.)				PM (No.)				PM (No.)		
	Capital ($)	Permanent	Other	O/M ($)	Capital ($)	Permanent	Other	O/M ($)	Capital ($)	Permanent	Other	O/M ($)
Preliminary Baseline Investigation												
Site Surveys												
Feasibility/ Manageability Studies												
Conceptual Design												
Land Acquisition												
Final Design												
Construction												
Operation												
Annual Assessment (Evaluation)		2	4	1.1		2	4	1.1		*2	4	1.1
Harvest/Protection			4	6.6			4	6.6			4	6.6
Maintenance				9.9				9.9				9.9
Totals		2	8	17.6		2	8	17.6		2	8	17.6

* Adults

* This can cease after 1991/92.

Table 29 Activity, cost ($ x 1,000) and labour flows

Key: Biology (engineering). Note: Labour costs not included in O/M.

Terra Nova River Activity	82/83				83/84				84/85			
		PM (No.)				PM (No.)				PM (No.)		
	Capital ($)	Permanent	Other	O/M ($)	Capital ($)	Permanent	Other	O/M ($)	Capital ($)	Permanent	Other	O/M ($)
Preliminary Baseline Investigation	5.5	1	8	22	5.5	5	8	22				
Site Surveys												
Feasibility/ Manageability Studies												
Conceptual Design												
Land Acquisition												
Final Design												
Construction												
Operation						3	8	22		3	8	22
Annual Assessment (Evaluation)												
Harvest/Protection												
Maintenance												
Totals	5.5(1.1)	4(1)	8(2)	22(5.5)	5.5	8	16	44		3	8	22

Table 29 Continued

Key: Biology (engineering). Note: Labour costs not included in O/M.

Terra Nova River Activity (con'd)	85/86				86/87				87/88			
		PM (No.)				PM (No.)				PM (No.)		
	Capital ($)	Permanent	Other	O/M ($)	Capital ($)	Permanent	Other	O/M ($)	Capital ($)	Permanent	Other	O/M ($)
Preliminary Baseline Investigation												
Site Surveys												
Feasibility/ Manageability Studies												
Conceptual Design												
Land Acquisition												
Final Design												
Construction										(2)	(10)	(88)
Operation		3	8	22		3	8	22		3	8	22
Annual Assessment (Evaluation)												
Harvest/Protection												
Maintenance												
Totals		3	8	22		3	8	22		3(2)	8(10)	22(88)

Table 29 Continued

Key: Biology (engineering). Note: Labour costs not included in O/M.

Terra Nova River Activity (con'd)	88/89				89/90				2006			
		PM (No.)				PM (No.)				PM (No.)		
	Capital ($)	Permanent	Other	O/M ($)	Capital ($)	Permanent	Other	O/M ($)	Capital ($)	Permanent	Other	O/M ($)
Preliminary Baseline Investigation												
Site Surveys												
Feasibility/ Manageability Studies												
Conceptual Design												
Land Acquisition												
Final Design												
Construction												
Operation												
Annual Assessment (Evaluation)	1	4	2.2		*1	4	2.2					
Harvest/Protection		4	1.1			4	1.1				4	1.1
Maintenance		(2)	(2.2)			(2)	(2.2)				(2)	(2.2)
Totals	1	8(2)	3.3(2.2)		1	8(2)	3.3(2.2)				4(2)	1.1(2.2)

* Can cease after 1982/83

Table 30 Activity, cost ($ x 1,000) and labour flows Key: Biology (engineering). Note: Labour costs not included in O/M.

Canairiktok River Activity	1982/83				1983/84				1984/85			
		PM (No.)				PM (No.)				PM (No.)		
	Capital ($)	Permanent	Other	O/M ($)	Capital ($)	Permanent	Other	O/M ($)	Capital ($)	Permanent	Other	O/M ($)
Preliminary Baseline Investigation	(a) 22(-)	b x 4 (Following)	b 4(-)	b (6.6)		a+4 1(-)	a 15(-)	a 11(-)		a 1(-)	a 15(-)	a 11(-)
Site Surveys	c -(1.1)	c -(4)	c -(11)					Contract (2) Water Level Data				
Feasibility/ Manageability Studies												(2.2)
Conceptual Design		(2)	(1)									
Land Acquisition					b(55)	b -(4)	b(2)	b(1.1)				
Final Design									b-(650)	b-(12) c-(0.5)	b-(8) c-(3)	b-(22) c-(33)
Construction										c 1(-)	c 24(-)	c 7.7(-)
Operation												
Annual Assessment (Evaluation)												
Harvest/Protection												
Maintenance												
Totals	22(1.1)	1(3)	4(5)	6.6(11)	55	1(4)	15(2)	11(3.1)	650	2(12.5)	39(11)	18.7(57.
	a) Contract For Disease work on Hunt Notakwanon, Coraluk, Anaktalik b) Electrofishing on Canairiktok c) On Canairiktok (under Contract) To include surveys fishways Also.				a) Electrofishing & Fyketrapping on Canairiktok plus one other b) In house (over winter) & review incubation box + collection facility				a) Electrofishing & Fyke trapping on Canairiktok plus one other b) Construction of (2 million eggs) incubation boxes c) Construction and operation of counting fence on flowers & Winter security.			

Table 30 Continued

Key: Biology (engineering). Note: Labour costs not included in O/M.

Canairiktok (con'd)

Activity	1985/86				1986/87				1987/88			
		PM (No.)				PM (No.)				PM (No.)		
	Capital ($)	Permanent	Other	O/M ($)	Capital ($)	Permanent	Other	O/M ($)	Capital ($)	Permanent	Other	O/M ($)
Preliminary Baseline Investigation		a 1(-)	a 15(-)	a 11(-)								
Site Surveys				(2.2)				(2.2)				
Feasibility/ Manageability Studies	b 16.5(-)	b 2(-)	b 8(-)	11(-)		(a) 2(-)	(a) 8(-)	(a) 11(-)				
Conceptual Design		c -(4)	c -(10)									
Land Acquisition										a -(6)	a -(4)	a -(2.2)
Final Design		d 1(-)	d 24(-)	d 7.7(-) e 8.8(-)		b 1(-)	b, 24(-)	b 7.7(-) c 8.8(-)		b 1(-)	b 24(-)	b 7.7(-) c 8.8(-)
Construction												
Operation												
Annual Assessment (Evaluation)												
Harvest/Protection												
Maintenance				23.1				23.1				23.1
Totals	16.5(-)	4(4)	47(10)	59.4(2.2)		3	32	50.6(2.2)		1(6)	24(4)	39.6(2.2)

a) Electrofishing & trapping on any remaining streams.
b) Semi-wild rearing (60 days) in tanks, remainder in cages.
c) Fishways for two obstructions
d) As before
e) Additional air time for Fry transfer

a) Semi-wild rearing b&C as before

a) Fishways on both obstructions (in hous b & c as before.

Table 30 Continued

Key: Biology (engineering). Note: Labour costs not included in O/M.

Canairiktok (con'd) Activity	1988/89											
		PM (No.)				PM (No.)				PM (No.)		
	Capital ($)	Permanent	Other	O/M ($)	Capital ($)	Permanent	Other	O/M ($)	Capital ($)	Permanent	Other	O/M ($)
Preliminary Baseline Investigation												
Site Surveys												
Feasibility/ Manageability Studies												
Conceptual Design												
Land Acquisition												
Final Design												
Construction	a (825)	a+b (3)	a+b (3)	a+b (33)	a) (1045)	a (3)	a -(3)	a (33)				
Operation												
Annual Assessment (Evaluation)												
Harvest/Protection											15	8.8
Maintenance				23.1				(23.1)				(23.1)
Totals	(825)	(3)	(3)	(56.1)	(1045)	(3)	(3)	(56.1)			15	8.8(23.
	a) Fishways (upper)				a) lower Fishways							

Table 31 Activity, cost ($ x 1,000) and labour flows

Key: Biology (engineering). Note: Labour costs not included in O/M.

Black Brook Activity	82/83				83/84				84/85			
		PM (No.)				PM (No.)				PM (No.)		
	Capital ($)	Permanent	Other	O/M ($)	Capital ($)	Permanent	Other	O/M ($)	Capital ($)	Permanent	Other	O/M ($)
Preliminary Baseline Investigation												
Site Surveys		(1)	(2)	(3.3)								
Feasibility/ Manageability Studies												
Conceptual Design												
Feb. 81 Land Acquisition												
Feb. 81 Final Design		(6)	(3)	.55								
Construction	462	(7)	(14)	16.5								
Operation		2	14	11		3	12	22		3	12	22
Annual Assessment (Evaluation)												
Harvest/Protection												
Maintenance						(1)	(2)	(6.6)		(1)	(2)	(6.6)
Totals	462	2(14)	14(19)	28.05(3.3)		3(1)	12(2)	22(6.6)		8(1)	18(2)	23.1(6.6)

Table 31 Continued

Key: Biology (engineering). Note: Labour costs not included in O/M.

Black BK (Con'd) Activity	85/86				86/87				87/88			
		PM (No.)				PM (No.)				PM (No.)		
	Capital ($)	Permanent	Other	O/M ($)	Capital ($)	Permanent	Other	O/M ($)	Capital ($)	Permanent	Other	O/M ($)
Preliminary Baseline Investigation												
Site Surveys												
Feasibility/ Manageability Studies												
Conceptual Design												
Land Acquisition												
Final Design												
Construction												
Operation		3	12	22		3	12	22		3	12	22
Annual Assessment (Evaluation)		5	6	1.1		5	6	1.1		5	6	1.1
Harvest/Protection												
Maintenance		(1)	(2)	(6.6)		(1)	(2)	(6.6)		(1)	(2)	(6.6)
Totals		8(1)	18(2)	23.1(6.6)		8(1)	18(2)	23.1(6.6)		8(1)	21(2)	24.2(6.6)

Table 31 Continued

Key: Biology (engineering). Note: Labour costs not included in O/M.

Black BK (con'd) Activity	88/89				89/90				90/91			
		PM (No.)				PM (No.)				PM (No.)		
	Capital ($)	Permanent	Other	O/M ($)	Capital ($)	Permanent	Other	O/M ($)	Capital ($)	Permanent	Other	O/M ($)
Preliminary Baseline Investigation												
Site Surveys												
Feasibility/ Manageability Studies												
Conceptual Design												
Land Acquisition												
Final Design												
Construction												
Operation		3	12	22		3	12	22		3	12	22
Annual Assessment (Evaluation)		1				1				1		
Harvest/Protection			3	1.1			3	1.1			3	1.1
Maintenance		(1)	(2)	(6.6)		(1)	(2)	(6.6)		(1)	(2)	(6.6)
Totals		4(1)	15(2)	23.1(6.6)		4(1)	15(2)	23.1(6.6)		4(1)	15(2)	23.1(6.6)

Table 32 Activity, cost ($ x 1,000) and labour flows

Key: Biology (engineering). Note: Labour costs not included in O/M.

Robinsons River Activity & Satellites	1983/84				1984/95 - Note				1995/96			
		PM (No.)				PM (No.)				PM (No.)		
	Capital ($)	Permanent	Other	O/M ($)	Capital ($)	Permanent	Other	O/M ($)	Capital ($)	Permanent	Other	O/M ($)
Preliminary Baseline Investigation												
Site Surveys												
Feasibility/ Manageability Studies												
Conceptual Design												
Land Acquisition												
Final Design												
Construction	a) (495)								a) (440)			
Operation		12	5	22		12	10	22		24	24	22
Annual Assessment (Evaluation)												
Harvest/Protection												
Maintenance												
Totals	495	12	5	22		12	10	22	(440)	24	24	22

a) Construction of Incubation Facility.

a) Expansion of Incubation Facility for satellite stocking.

Table 33 Activity, cost ($ x 1,000) and labour flows

Key: Biology (engineering). Note: Labour costs not included in O/M.

Indian Bay Brook Activity	1984/85				1985 (1995)-Note				1995/96			
		PM (No.)				PM (No.)				PM (No.)		
	Capital ($)	Permanent	Other	O/M ($)	Capital ($)	Permanent	Other	O/M ($)	Capital ($)	Permanent	Other	O/M ($)
Preliminary Baseline Investigation												
Site Surveys												
Feasibility/ Manageability Studies												
Conceptual Design												
Land Acquisition												
Final Design												
Construction	(a) (440)								(a) 110			
Operation		12	17	11		12	17	11		24	22	22
Annual Assessment (Evaluation)												
Harvest/Protection												
Maintenance												
Totals	(440)	12	17	11		12	17	11	110	24	22	22

(a) Construction of incubation Facility

Expansion of incubation Facility for stocking satellite.

Table 33 Continued

Key: Biology (engineering). Note: Labour costs not included in O/M.

Indian Bay BK. (cont'd) Activity	1996/97											
		PM (No.)				PM (No.)				PM (No.)		
	Capital ($)	Permanent	Other	O/M ($)	Capital ($)	Permanent	Other	O/M ($)	Capital ($)	Permanent	Other	O/M ($)
Preliminary Baseline Investigation												
Site Surveys												
Feasibility/ Manageability Studies												
Conceptual Design												
Land Acquisition												
Final Design												
Construction												
Operation		24	22	22								
Annual Assessment (Evaluation)												
Harvest/Protection												
Maintenance												
Totals		24	22	22								

Table 34 Activity, cost ($ x 1,000) and labour flows Key: Biology (engineering). Note: Labour costs not included in O/M.

Gander Bay Activity	1983/84				84/85				85/86			
		PM (No.)				PM (No.)				PM (No.)		
	Capital ($)	Permanent	Other	O/M ($)	Capital ($)	Permanent	Other	O/M ($)	Capital ($)	Permanent	Other	O/M ($)
Preliminary Baseline Investigation					1.1	+3 1	4	5.5				
Site Surveys		(2)	(2)	(2.2)								
Feasibility/ Manageability Studies												
Conceptual Design		(1)	(1)									
Land Acquisition			(1)									
Final Design		(2)	(3)	(1.1)					(550)	(5)	(5)	
Construction										2	19	28.6
Operation												
Annual Assessment (Evaluation)												
Harvest/Protection												
Maintenance												
Totals		(5)	(7)	(3.3)	1.1	1	4	5.5	(550)	2(5)	19(5)	28.6

Table 34 Continued

Key: Biology (engineering). Note: Labour costs not included in O/M.

Gander Bay Activity (Cont'd)	86/87				87/88				88/89			
		PM (No.)				PM (No.)				PM (No.)		
	Capital ($)	Permanent	Other	O/M ($)	Capital ($)	Permanent	Other	O/M ($)	Capital ($)	Permanent	Other	O/M ($)
Preliminary Baseline Investigation												
Site Surveys												
Feasibility/ Manageability Studies												
Conceptual Design												
Land Acquisition												
Final Design												
Construction												
Operation		3	19	27.5		3	19	27.5		3	19	27.5
Annual Assessment (Evaluation)						5	6	1.1		5	6	1.1
Harvest/Protection												
Maintenance		(1)	(2)	(6.6)		(1)	(2)	(6.6)		(1)	(2)	(6.6)
Totals		3(1)	19(2)	27.5(6.6)		8(1)	25(2)	28.6(6.6)		8(1)	25(2)	28.6(6.6

Table 34 Continued

Key: Biology (engineering). Note: Labour costs not included in O/M.

Gander Bay Activity (Con'd)	89/90				90/91				2006			
		PM (No.)				PM (No.)				PM (No.)		
	Capital ($)	Permanent	Other	O/M ($)	Capital ($)	Permanent	Other	O/M ($)	Capital ($)	Permanent	Other	O/M ($)
Preliminary Baseline Investigation												
Site Surveys												
Feasibility/ Manageability Studies												
Conceptual Design												
Land Acquisition												
Final Design												
Construction												
Operation		3	19	27.5		3	19	27.5		3	19	27.5
Annual Assessment (Evaluation)		5	6	1.1		2	3	1.1		1		
Harvest/Protection							8	3.3				
Maintenance		(1)	(2)	(6.6)		(1)	(2)	(6.6)		(1)	(2)	(6.6)
Totals		8(1)	25(2)	28.6(6.6)		5(1)	30(2)	31.9(6.6)		4(1)	27(2)	30.8(6.6

Table 35 Activity, cost ($ x 1,000) and labour flows

Key: Biology (engineering). Note: Labour costs not included in O/M.

Torrent Activity / Sattelite	84/85				85/86				86/87			
		PM (No.)				PM (No.)				PM (No.)		
	Capital ($)	Permanent	Other	O/M ($)	Capital ($)	Permanent	Other	O/M ($)	Capital ($)	Permanent	Other	O/M ($)
Preliminary Baseline Investigation		1	2	8.8	3.3	3	12	20				
Site Surveys		(2)	(2)	(2.2)								
Feasibility/ Manageability Studies												
Conceptual Design												
Land Acquisition						(1)						
Final Design						(3)	(3)	(5.5)				
Construction									(550)			(33)
Operation										2	14	34.1
Annual Assessment (Evaluation)												
Harvest/Protection												
Maintenance												
Totals		1(2)	2(2)	8.8(2.2)	3.3	3(4)	12(3)	20(5.5)	(550)	2	14	34.1(3

Table 35 Continued

Key: Biology (engineering). Note: Labour costs not included in O/M.

Torrent Sattelite Activity (cont')	87/88				88/89				89/90			
		PM (No.)				PM (No.)				PM (No.)		
	Capital ($)	Permanent	Other	O/M ($)	Capital ($)	Permanent	Other	O/M ($)	Capital ($)	Permanent	Other	O/M ($)
Preliminary Baseline Investigation												
Site Surveys												
Feasibility/ Manageability Studies												
Conceptual Design												
Land Acquisition												
Final Design												
Construction												
Operation		2	30	34.1		3	30	34.1		3	30	34.1
Annual Assessment (Evaluation)						15	18	4.4		15	18	4.4
Harvest/Protection												
Maintenance		(1)	(2)	(6.6)		(1)	(2)	(6.6)		(1)	(2)	(6.6)
Totals		2(1)	30(2)	34.1(6.6)		18(1)	48(2)	38.5(6.6)		18(1)	48(2)	38.5(6.6)

Table 35 Continued

Key: Biology (engineering). Note: Labour costs not included in O/M.

Torrent R. (Cont'd) Activity	90/91				91/92				92/93			
		PM (No.)				PM (No.)				PM (No.)		
	Capital ($)	Permanent	Other	O/M ($)	Capital ($)	Permanent	Other	O/M ($)	Capital ($)	Permanent	Other	O/M ($)
Preliminary Baseline Investigation												
Site Surveys												
Feasibility/ Manageability Studies												
Conceptual Design												
Land Acquisition												
Final Design												
Construction												
Operation		3	30	34.1		3	30	34.1		3	30	34.1
Annual Assessment (Evaluation)		5	18	4.4		5	18	4.4		5	18	4.4
Harvest/Protection												
Maintenance		(1)	(2)	(6.6)		(1)	(2)	(6.6)		(1)	(2)	(6.6)
Totals		8(1)	48(2)	38.5(6.6)		8(1)	48(2)	38.5(6.6)		8(1)	48(2)	38.5(6.6)

Table 30 Activity, cost ($ x 1,000) and labour flows

Key: Biology (engineering). Note: Labour costs not included in O/M.

South Brook Activity	86/87				87/88							
		PM (No.)				PM (No.)				PM (No.)		
	Capital ($)	Permanent	Other	O/M ($)	Capital ($)	Permanent	Other	O/M ($)	Capital ($)	Permanent	Other	O/M ($)
Preliminary Baseline Investigation												
Site Surveys												
Feasibility/ Manageability Studies												
Conceptual Design												
Land Acquisition												
Final Design												
Construction	(495)	12	17	22								
Operation						12	17	22				
Annual Assessment (Evaluation)												
Harvest/Protection												
Maintenance												
Totals	(495)	12	17	22		12	17	22				

APPENDIX D

Public Involvement Enhancement:

(a) Discussion paper:

Status of public involvement in salmon enhancement, Newfoundland and Labrador.

(b) Some salmonid harvesting policy considerations for Atlantic salmon enhancement projects - Newfoundland Region

(c) Description of enhancement program project activity, production, cost and person year flows, restoration and maintenance and improvement of stocks, public involvement projects:

- Salmon Cove Brook, Bayswater Rod and Gun Club
- Salmon Cove-Port Union Brooks, Bonavista Development Association
- Hickman's Harbour River, Random Island North Development Association
- Brian's Feeder, Central Development Association
- Grand Lake River Enhancement, Humber Valley Development Association
- Fox Island-Romaines River Enhancement, Salmon Preservation Association of Western Newfoundland
- Northern Labrador River Enhancement, Torngat Fish Co-Op

(d) Status reports to April, 1984

- St. Mary's Bay North Salmon Enhancement Project
- Black Brook Salmon Enhancement Project
- Terra Nova River Salmon Enhancement Proposal
- Canairiktok River Salmon Enhancement Proposal
- Barry's Brook Salmon Enhancement Proposal
- Salmon Cove Salmon Enhancement Proposal

(e) Unreviewed proposals

- Burin Peninsula River Enhancement Proposals, Burin Town Council and Monkstown Local Development Committee
- Bay D'Espoir Salmon Aquaculture Proposal, Bay D'Espoir Development Association

(a) Discussion Paper on the Status of Public Involvement in Salmon Enhancement, Newfoundland-Labrador With Reference to Future Opportunities and Requirements

J. D. Pratt, T. R. Porter, and A. Jamieson
Department of Fisheries and Oceans

(a) Discussion Paper On The Status of Public Involvement in the Salmon Enhancement Plan Newfoundland-Labrador With Reference To Future Opportunities and Requirements

Preamble

During 1980, the Newfoundland Region initiated a public involvement salmon enhancement project on Colinet River, St. Mary's Bay North, Avalon Peninsula. The experience has been advantageous in terms of exploring and devising appropriate mechanisms and processes for operating public projects, and in terms of gaining outside agency support to conduct additional projects. This demonstration project has provided considerable insight on ways of working with other Public Groups and has greatly aided with incorporating public involvement into the 1980-82 salmon enhancement program planning exercise.

1. Potential Opportunities Scope and Types of Projects

A major emphasis of the developing federal-provincial initiative for salmon enhancement will be public projects. The relatively simple techniques and strategies included in the current Newfoundland-Labrador enhancement plan lend themselves to public involvement with a major focus on low-capital, employment-intensive projects. The transfer of the basic skills to the public through on-the-job DFO training approaches is proving effective. Candidate projects in Newfoundland include fishway and stream remedial activities; colonization (i.e. provision of fish passage at total salmon migration obstructions complemented by 5-7 years of stocking) and pond rearing (i.e. the continuous planting of swim-up salmon fry into selected standing waters; at the appropriate life stage these salmon will naturally go to sea to contribute to fisheries).

With the provision of appropriate extension and other services, cooperative research and development with provincial agencies interested in salmonid aquaculture may be considered in south coast insular areas such as Bay D'Espoir. This would be based on further refinements of current local pen rearing tests coupled with a continuous supply of one year smolts.

Native involvements in salmon enhancement could eventually become important, especially in remote areas where opportunities for improving income, employment and education are low. For example, the Inuit people of northern Labrador have recently indicated interest in development of new salmonid fisheries. And the Conne River Indians of south coast insular Newfoundland have already made representations to provincial fishery agencies respecting their potential involvement in salmon aquaculture ventures.

Newfoundland is unique in having an administrative network through the Department of Rural Agriculture and Northern Development of some 49 Regional Development Association offices representing 500 communities. Certain of those Associations have already requested sponsorship of public salmonid enhancement proposals. About 15 Fishery and Wildlife Conservation Associations also offer some capacity as project sponsors.

Public involvement projects could constitute about one half of the production from a ten year salmon enhancement program plan and considerable funding could be provided by agencies other than DFO. Planning Groups for the proposed program have provided objectives and criteria describing three categories of projects (Attachment I). It is obvious from the objectives outlined in the attachment that public involvement projects could target on an entire mix of

goals, including increased net incomes, employment, regional development, native peoples, environmental preservation and public education/training. As to the types of projects being considered, Category II and III projects predominate within seven enhancement proposals that have already been received and screened by the Technical Planning Committee (Appendix D(b)). Project proposals which emphasize volunteer-education principles (i.e. Category I) might be expected to become more frequent in populated areas of the Island and western Labrador if incremental budget resources provided suitable DFO administrative, coordinative, training and education thrusts.

2. Benefits That Can Be Derived From Community Involvement

Public involvement initiatives both on the Pacific and Atlantic coasts have shown that substantial benefits can be generated in terms of fish production, economics, employment and human development with considerable flexibility in the mix of benefits obtained, both on the short and long term. Also, it is possible for DFO to consider outside agency funding and take advantage of public interest through contractual or grant arrangements. This approach is dependent on the acquirement of DFO technical advice, coordination, training and control mechanisms which would channel the outside departmental funding and public energy towards goals that are of mutual interest to the participants (for details see Attachment II: "SAEN's Avalon Peninsula Program" by D. G. Hustins).

As an example, the St. Mary's North River Demonstration Project (Colinet River) in Newfoundland mainly satisfies DFO goals relating to the benefits of increased fish production, conservation, environmental preservation and education. CEIC, as a partner in the project, is mainly interested in employment, training and potential recruitment of trainees to other potential enhancement projects. The Salmon Association of Eastern Newfoundland (SAEN), as Project Sponsor, has goals that also pertain to Atlantic salmon preservation, management and enhancement; it provides the project administration and management under contract and during the 1980-82 period there have been "costs" incurred by all three participants. DFO has provided about two-thirds of one person year annually from existing budgets towards advice and coordination on bio-engineering, management, harvesting and training aspects of this project, plus $10,000 in the first year for project manager salaries. CEIC has invested about $300,000 over the two year period under its CCDP and LEAP programs. This funding has been used to commission the project and to hire 12-14 seasonal trainees from two communities who conduct the enhancement under direction of the sponsor's project manager. The SAEN Executive who sponsor the project, is a highly committed volunteer group which donates considerable time to general planning and administration. Additional funding and public support are sought for supplementary activities such as the development of teaching kits for use in local school districts to inform about the project and to educate on the broader aspects of salmon biology, ecology, enhancement and resource preservation.

Although economic production benefits remain the prime object of any fisheries development program, smaller scale public projects may not reflect the same "benefit:cost" performance of some larger scale projects. Although public involvement should be designed to pay its way, it should also serve as the avenue by which benefits such as employment and training, regional development, native peoples, education and environmental preservation enter a program. Public involvement provides a major opportunity to inject the desired mix of

economic and social benefits into a long-term fisheries enhancement program.

3. A Major Problem Associated with DFO Servicing of Public Involvement, Newfoundland Region

Public involvement under contractual arrangements requires considerable input and administration by DFO staff. For this reason, in Newfoundland, DFO has had to refrain from intensive public consultations on certain resource development plans and proposals since the modest person year and O/M increments to support the administration and coordination of public involvement are not available. Hence, internal DFO budgetary constraints preclude implementation of additional public projects. If this situation prevails, there is the attendant risk of greatly dampened public enthusiasm and interest towards the program.

4. Mechanisms for Identification, Review and Approval of Projects Monitoring Progress and Funding

During planning of the public involvement component of the Newfoundland enhancement program, a screening review and evaluation process was formulated for the three major categories of projects (Attachment I). The Technical Planning Group for enhancement has also had to act as a DFO screening approval and monitoring agent for public projects such as that of St. Mary's North. This multi-disciplined body meets annually to review the project in detail (i.e. results of the past year and the plan submitted by the sponsor for the new year in the context of the initial multi-year proposed plan and goals). In the case of St. Mary's Project, a Steering Committee has also been established and meets every two months on the project site to conduct field inspections and assess progress. DFO chairs this Committee and representation is also provided by CEIC, SAEN, two local community councils, the local development association and the fishermen's local union. In addition to this, CEIC conducts an independent interdepartmental performance evaluation each year which is based in part on the deliberations of the Technical Working Group and Project Committee. This evaluation occurs prior to release of LEAP funding for the new budget year.

Such mechanisms as the above appear adequate to accomodate present public projects. However, any new projects would very likely necessitate the establishment of a Regional Steering Committee, and possibly the establishment of a special DFO public involvement unit composed of bio-technical, coordination and training specialists (i.e. 4 person years plus supporting budget). Such mechanisms could service numerous project steering and planning committees.

5. DFO Funds That Might Be Identified Within Regions For Such Projects and Their Administration

Existing DFO budget and person year allocations are being strained to meet current enhancement priorities. Some internal reorganization could provide limited facility for administering public involvement. CEIC is now firmly interested in funding portions of specific projects which relate to its mandate. But if increased public involvement is to proceed in an effective way, a modest increment of person year funding must be approved for purposes of administration.

In summary, it would appear that if any serious DFO effort is to be initiated and maintained on public projects, long-term incremental resources must be

gained through new Treasury Board Submissions similar to the DREE/DFO salmon enhancement document developed in March-April, 1981. In addition to administration, DFO should be prepared to at least share some of the major funding burden with outside agencies such as CEIC (considering that the public involvement is addressing fisheries mandate considerations).

6. A National Coordinated Approach to Public Involvement Projects

There is a need for national coordination of public involvement especially in the areas of policy development of East-West exchanges and administering Headquarters budgeting systems.

One priority area for further policy development on public involvement in this Region relates to adopting new harvesting strategies on enhanced production within common property fisheries. If some of the revenues from enhanced production could be used to recover costs within employment contracts issued to non-profit public enhancement/aquaculture groups, considerable long-term CEIC-LEAP funding appears feasible in support of new resource development projects. It seems logical that Ottawa should coordinate such an initiative.

Arrangements to allow freer access to information and easier development of contacts similar to that within the well-established Pacific initiative would greatly assist the Newfoundland Region if public involvement accelerates. It is suggested that a contact office in Ottawa would also be required to effectively service and coordinate increased Treasury Board and other submissions.

ATTACHMENT I

Submission to Core Planning Group by Technical Working Group Concerning the Types of Projects that Should be Considered Within a Public Involvement Component of a Newfoundland Atlantic Salmonid Enhancement Program.

A. Draft Objective for Component:

1. To provide increased opportunity for the public to improve their well-being through participation in Atlantic salmon enhancement.

2. To provide new avenues of economic fisheries development with generation of net monetary income within the community.

3. To provide increased opportunity for community development through increased employment, regional development and environmental preservation.

4. To provide native groups within the communities with an opportunity to develop life-styles more in keeping with their cultural heritage.

5. To develop and establish on-job and institutional training programs that ensure the effectiveness and performance of the public in developing, operating and administering enhancement projects.

6. Develop a province-wide education/information system that promotes public awareness of concerns for and commitment to the protection and preservation of the Atlantic salmon resource and its environs, along with appreciation of government efforts to manage and develop the resource.

TYPES OF PROJECTS

Category I. Public Interest/Participation Projects

These projects would:

(a) be small in size (capital <25K) and of short duration (<5 years);

(b) be of low technology (e.g. habitat improvement, minor stream clearance);

(c) offer perceptible benefits in the areas of conservation, education, environmental preservation and native wellbeing (but only minor economic benefits realized);

(d) be supported mainly by volunteer labour with material assistance from DFO to other sources;

(e) have DFO input mainly at the planning stages but will inspect work in progress and upon completion).

Category II. Public and Community Development Projects

These projects would:

(a) be medium in size (capital <100K) and last up to 5 years;

(b) be of medium technology (e.g. colonization through stocking and provision of fish passage, habitat improvement/enrichment);

(c) offer considerable benefits in the areas of conservation, education, environmental preservation and native well being, but only marginal economic benefits and short-term employment;

(d) supported by volunteer labour and/or contract-out to local community residents through public service groups, community development associations, etc.;

(e) have DFO input during the planning, implementation and operational phases which are undertaken by the proponent.

Category III. Community Development Projects

These projects would:

(a) be large in size (capital >100K) and last more than 5 years;

(b) be medium to high scale technology (e.g. colonization with fed products, semi-wild rearing (fingerlings parr smolts) sea ranching (smolts); aquaculture (smolts);

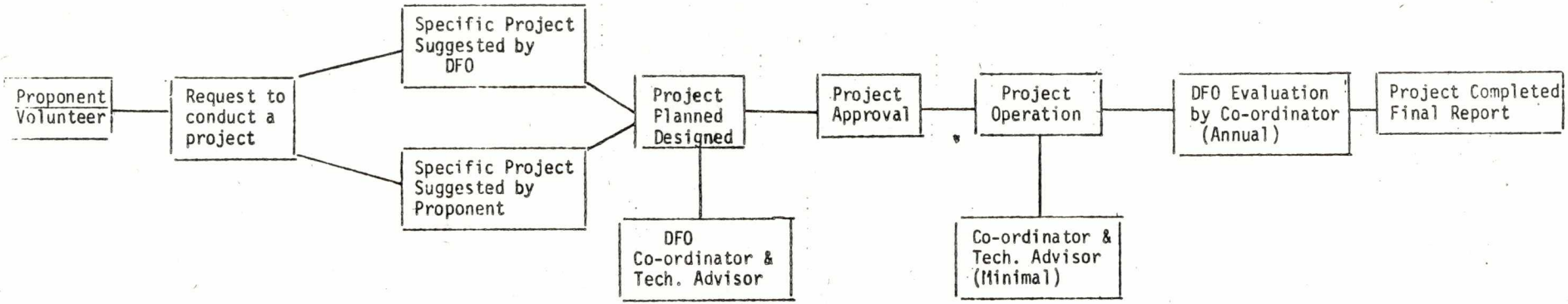
(c) have significant economic, long/short-term employment and regional development benefits and also offer considerable benefits in the areas of conservation, education, environmental preservation and native well being;

(d) Supported mainly through contract-out or harvest benefits accruing to the local community residents with sponsorship provided through the community;

(e) have DFO input during the planning, implementation and operational phases which are undertaken by the proponent, in certain cases DFO may directly propose, design and operate projects.

Comment: This submission for our purposes lacks policy development relative to DFO and other Departments.

CATEGORY I



CRITERIA:

(a) Volunteer - Labour
- Operating Funds
(b) Low technology
(c) Max. DFO Capital Funds $75,000.
(d) Min. DFO Involvement
(e) Normally no significant fish production anticipated
(f) Project duration <5 years

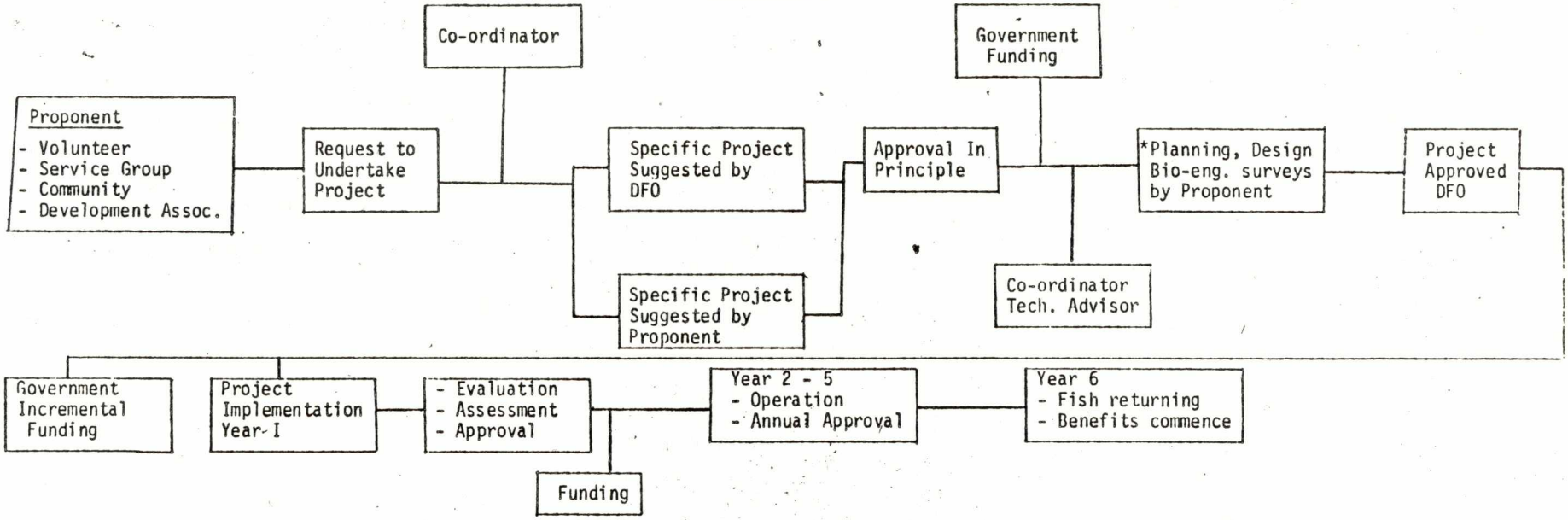
KINDS OF ACTIVITIES:

(a) Educacate project operators photo type facilities
(b) Habitat improvement
(c) Minor stream remedial

BENEFITS:

(a) Education, training
(b) Public awareness
(c) Conservation
(d) Aesthetics
(e) Possibly small numbers of fish but not sufficient for economic benefits

CATEGORY II



* Possibly contracted out by proponent

CRITERIA:

1. Max. 5 years
2. Funding < $100,000
3. Low to Med. Technology
4. Tangible long term benefits to user groups

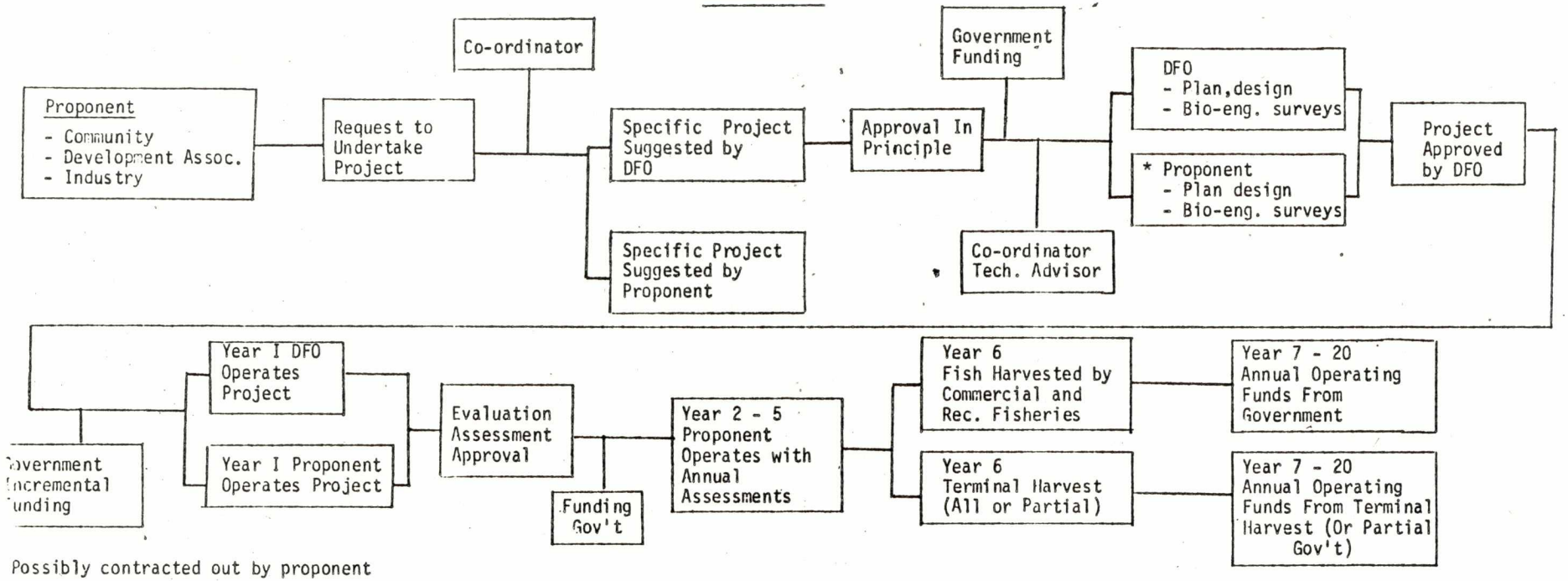
KINDS OF ACTIVITIES:

1. Colonization
   (a) Fish passage construction
   (b) incubation facilities
   (c) stocking program
   (d) habitat enrichment
2. Stream Habitat Improvement

BENEFITS:

1. Short term employment
2. Increased economic returns to commercial and recreational fishing related industries via increased fishing days or increased number of fish with same effort.
3. Native involvement
4. Conservation
5. Training - education - aesthetics
6. Public support

CATEGORY III



Possibly contracted out by proponent

ITERIA :

- Requires continual operation after 5 yrs.
- Funding > $100,000.
- Short term employment
- Long term employment
- Economic benefits
- Benefits to community or region
- Potential for benefits to finance continued operations

→ med to high Tech

KINDS OF ACTIVITIES:

1. Sea ranching
2. Aquaculture
3. Colonization
4. Incubation facilities for stock out projects

BENEFITS:

1. Short term employment
2. Long term direct employment in project
3. Long term employment in fishing related industry - primary, secondary and service - via
   (a) increased economic returns to fishermen
   (b) increased number of fishermen
   (c) service and secondary industries
4. Native involvement
5. Education and training
6. Conservation
7. Public support

Some Salmonid Harvesting Policy Considerations for Atlantic Salmon Enhancement Projects - Newfoundland Region

Department of Fisheries and Oceans

St. John's, Newfoundland

CONTENTS

Some Salmonid Harvesting Policy Considerations for Atlantic Salmon Enhancement Projects - Newfoundland Region

A. Summary

With an expected increase in harvests within local Atlantic salmon fisheries from enhancement, the Newfoundland Region is proposing that a mechanism should be considered to allow harvest sales on a portion of the enhanced stocks to support publicly-sponsored enhancement projects. In this respect, but in the interests of continuing to maintain natural genetic diversity and life history patterns of salmon stocks, it is practical to consider the concept of terminal fisheries within the new areas of developed production where the stock composition is relatively homogeneous.

A similar approach is presently being reviewed by DFO Pacific Region concerning Pacific salmon sea ranching and mariculture developments in British Columbia prior to further consideration by Cabinet. It therefore appears timely to provide the Newfoundland viewpoint considering the national implication of any Pacific policy recommendation adopted at a Ministerial level.

As terminal harvesting is a relatively untried and controversial concept, it is recommended that cost-effective public projects (such as Black Brook, Halls Bay) engage in terminal fisheries on a trial basis to allow more refinements of the management and economic aspects on the basis of discrete, separate stock units in the area where they have been produced. The pilot projects would also provide an opportunity to explore policy issues surrounding agreements with public sponsors in relation to product quality, processing and marketing.

Appropriate mechanisms should be explored that would allow fish sales to be routed or credited back to the project so as to defray costs and thereby ease funding burdens of both DFO and other agencies financially supporting the ventures. In the event that the Cabinet Review is supportive of the Newfoundland proposal, for a cost defrayal mechanism then the matter of revenue from sales of fish from enhanced stocks should receive further federal-provincial consultation due to provincial proprietary rights in freshwater fisheries.

B. Introduction

In recent decades the Atlantic salmon stocks of Newfoundland-Labrador have shown signs of decline that have been attributed to a variety of man-made and natural causes. DFO planning committees have been addressing the various problems. Their recommendations have resulted in major shifts in DFO management policy for the resource as announced in 1980 (reference document). In addition to new provincial fishery restrictions, management consultative systems and international controls, the planning groups urged consideration of an economic development approach which would increase and improve fishery benefits through the integration of a long-term enhancement program. As a

consequence, during the 1980-82 period, three federal and six provincial agencies in Newfoundland collaborated on special working groups in the design of a ten-year salmon enhancement plan aimed at doubling current commercial (i.e 2000 metric tonnes) and recreational (i.e. 40,000 adults) catches in a cost effective manner. The plan as developed is based on 5 enhancement strategies containing a total of 21 projects applying low to intermediate technologies which are conducive to stimulating direct involvement of the public.

Although the plan has not yet received ministerial or public review, 6 of these 21 projects are proceeding and allow refining or piloting of various strategies of the plan. This will result in initial realization of one quarter of the total projected salmon production, plus considerable employment and other social benefits. A reduced five year flow of investment and manpower is being sourced and assembled using existing DFO enhancement budgets, CEIC Job Creation and LEAP programs, plus special DFO allocations supporting the Job Creation programs. However, additional sources of seed and follow-on funding will be required. With the expected increase in harvests within local fisheries, this Region is proposing that a mechanism should be considered to allow harvest sales on a portion of the enhanced stocks for support of publicly-sponsored enhancement projects. The development and adoption of such a principle would ease funding burdens to both DFO and outside agencies with project interests in the demonstration or later phases of the Newfoundland enhancement plan.

The 1982 Pearse Commission on Pacific Fisheries Policy has reviewed recent sea-ranching and mariculture developments and opportunities in British Columbia with a view towards a special lease system. This would allow a leasee to ocean ranch Pacific salmon under DFO criteria and controls with respect to location/operation of stream enhancement projects and to habitat management and harvesting regimes. Acceptable proposals for ocean ranching would minimize interference with established wild salmon stocks through harvest as close to the production facility as possible. Moreover, much of the enhanced fish would be taken in the traditional common property fisheries outside the project area of production and harvest. Those fish returning to the project area would then be allocated as project brood fish or as terminal harvest sales for the project thereby "linking more directly those who incur the costs (of enhancement) with those who would benefit".

Stocking applications of the Newfoundland plan rely heavily on colonization, pond ranching or stream remedial approaches which all have ocean ranching as an underlying principle. For the most part, the plan will maintain the natural genetic diversity and life history patterns of the salmon stocks. This will be accomplished by expansion of smolt production to upstream watershed areas not currently occupied by salmon. Brood stock for such expanded production will be provided by the homewater or a nearby river. Hence, it is practical to consider the concept of terminal fisheries for those new areas of production where the stock composition is homogeneous.

The Pacific policy recommendations respecting enhancement lease arrangements directly pertain to the Newfoundland situation. Since those recommendations are to receive DFO consideration during a Cabinet review in November 1983, it now appears timely to provide the Newfoundland viewpoint

considering the national implication of any policy adopted at the Ministerial level.

C. Salmonid Harvest Policy Considerations, DFO

1. General Impact of the Enhancement Plan on Fisheries.

Commercial fishermen, recreational fishermen and native peoples are the recognized users of the Atlantic salmon resource of Newfoundland-Labrador. The native peoples of Labrador conduct a harvest for salmonids under a system of special food permits. About 4800 commercial fishermen are licensed and take about 90% of the total commercial salmon harvest of Atlantic Canada. In addition about 40,000 anglers are responsible for the annual sports creel which represents 30-40% of the total Canadian angling catch.

The enhancement plan, besides doubling the overall production/harvest base would serve other major advantages. Certain enhancement projects would ease socioeconomic dislocation in the local fisheries. For example, the current plan would compensate the fisheries for new management restrictions (such as reduced interceptions of mainland origin salmon by appreciably increasing catches of Newfoundland origin salmon through enhancement projects located in the commercial fishery area most seriously affected). The plan would also create enhancement projects with production-harvest systems that safeguard established stocks while minimizing project costs, maximizing harvest allocation and improving product quality or diversity. The underlying interest of this paper is the directed approach that salmon enhancement offers for intensive management and controlled harvest at in-river facilities where discrete harvest of any enhanced surplus, over brood requirements, is possible.

2. The Harvesting Strategy for New Enhancement Projects.

In the most typical circumstance, a river enhancement facility (for example stream-side incubator with adult collection and holding facilities) under contract to a public sponsor group would be used to stock an upstream inaccessible area as part of a sea ranching strategy of production. After one to four years of successive stocking of the upstream area with fry, fingerling or smolt products, many adults would return to commercial and recreational fisheries located downstream of the production facility. The remaining fish would return to the facility.

3. Harvest Allocation Quality and Marketing.

Even after harvests within existing fisheries the number of enhanced fish available at the facility for brood is expected to be five to tenfold that required to perpetuate the run. This imbalance results from the higher freshwater reproductive survival efficiencies provided by a fish culture facility. Hence a further terminal river

fishery for commercial harvest of the surplus spawning escapement becomes possible at the enhancement facility. A new terminal harvest would thereby be made possible that would potentially yield between 10-25% of the total enhanced stock.

In most cases, the costs associated with identifying and harvesting the excess enhanced production within existing fisheries rather than within terminal fisheries appears prohibitive. In addition, preliminary assessments on the flesh quality of salmon entering fresh water indicate that no serious deterioration would occur in fish quality if fish were terminally harvested within 3 months of entering the rivers. The fish returning to the facility would be used as brood fish for future stocking or declared surplus and made available for commercial harvest in a small abattoir. Controlled killing and processing practices on fish slaughtered would improve quality plus increase diversity of, and demand for, the salmon products in the market place. The returning harvested salmon would not be caught in traditional gill nets, but rather in live traps. This means less physical damage and proper bleeding at the harvesting point and prompt processing and preservation following killing. In most areas, processing facilities are available which could ice, freeze, glaze, smoke, cure or can the suitable quality fish resulting in higher demand and price for an assortment of products. In addition, river harvests would be later than the traditional commercial fishery, thereby extending the annual period during which salmon products are supplied thus offering greater stability within markets. In most cases, transportation facilities are readily available to ensure rapid shipment of the river fishery products to processing facilities and to domestic or distant markets.

The idea of allocating part of the terminal harvest to include special recreational fisheries that realize revenues for a public sponsor does not appear tenable or practical at this time. There could be angling of the harvestable surplus within raceways of the facility or within adjacent special lease areas. There are no such leasing systems for salmon angling fisheries in Newfoundland waters and the concept is not presently supported by the federal government. Enhanced fish could be allowed to move upstream of the facility into common property angling fisheries but special angling fees could not be levied on behalf of the sponsor; this implies lost revenues from sales within the terminal fishery. Moreover, there would be serious DFO management concerns since it confounds decisions on brood allocations at the facility. The unknown residual spawning levels created by fish escaping the angling complicate determinations of appropriate facility brood requirements for fully stocking the same area.

4. Sponsors of Enhancement Projects.

The new enhancement plan emphasizes several projects that draw heavily on community groups. The technical simplicity and cost of

most of the ranching-type projects outlined make them especially amenable to community involvement. This will provide net monetary income generation as well as increased employment within remote areas of the province with high seasonal unemployment. Within Newfoundland there exists an administrative network of 49 Regional Development Associations (representing 500 communities) which work toward improving the social and economic well being of their respective geographic regions. Because of their community development interests, several of those associations have already prepared and submitted enhancement project proposals which could be implemented under their sponsorship. These proposals could involve such river harvesting schemes. Also, certain conservation groups and rod and gun clubs have provided proposals for fishery and community developments. They all represent non-profit groups with special commitments and interests in preserving and increasing the resource. Allowing terminal harvests under special DFO agreements with such groups conducting enhancement would enable a more business oriented approach to the enhancement projects. A portion of the harvest sales from increased salmonid populations would be available for supporting the implementation, maintenance and even expansion of the project operations.

D. Pilot Enhancement Project

Terminal harvesting remains a relatively new, untried, and controversial concept within the traditional salmon fisheries of Atlantic Canada. For years certain user and special interest groups have proposed the concept often referred to as "river-mouth harvesting" or "headland principle") as the solution to reducing the cropping of mixed stocks within the inshore commercial gear. It has therefore often been proposed that the harvest of stocks closer to their river of origin be initiated on a trial basis to allow more rational management on the basis of discrete, separate stock units in the area where they have been produced. However, in most areas of the Newfoundland fishery, socioeconomic factors preclude suggested shifts in harvesting from the inshore to river production locations. The new river enhancement projects would offer the opportunity and flexibility for resource managers to bring about some fishing rationalization. Properly chosen pilot projects would refine management regimes that pose minimal interference to existing wild stocks during harvest of enhanced stocks. Those projects would also provide the opportunity to explore policy issues surrounding the licensing of public sponsors in relation to product quality, processing and marketing. An additional result would be the opportunity to explore and devise appropriate mechanisms that would ensure that project fish sale revenues are routed to the project at levels commensurate with the investment in enhancement.

The Indian River watershed should be considered as a candidate enhancement project for testing and fine tuning a policy as it relates to the above harvesting disposition and sale of fish. The first phase of this project on Black Brook, a tributary draining into the upper portion of Indian River (Fig. 1) is now underway. It involves the construction of two deep substrate incubators plus adult live trapping, holding and spawning facilities. The

facilities collect and hold adults returning to river area upstream where they were originally stocked and reared.

In its first phase the project has a production capacity of 16,000 adults. Later refinements in technology, plus expansion of the facility, and satellite stocking of salmon fry and fingerling products within standing water/stream habitats of the Indian River and South Brook systems could result in an ultimate production of as high as 70,000 adults by the mid-1990s. The Green Bay and Baie Verte Development Associations are co-sponsoring the construction and long-term operation of the project. During 1983 CEIC is providing most of the contractual funding and manpower under the NEED Job Creation Program. DFO provided special funding during 1982 for support of the development phase and has committed follow-on funding commencing in 1984. DFO will also supply the sponsor with considerable research input and direction during the next five years to ensure comprehensive evaluation and firm-up of the stocking methodologies.

The physical nature of the watershed is ideal for the application of harvesting, processing and marketing evaluations. The stock composition of the harvest, plus allocations of enhanced adult returns and the quality of the returns could be assessed at migratory obstructions on the Black and Burnt Berry Brook tributaries. The Black Brook location of assessment would be approximately 45 km upstream of the river estuary and 5 km above the confluence with Indian River. In contrast, the Burnt Berry location of assessment would be only 3.5 km above the river estuary and less than 1 km above confluence with Indian River. The assessment situation within these two tributaries would allow several comparative measurements with respect to homing and homogeneity of stocks harvested and the quality of the freshwater harvest at varying distances/timings away from salt water. Salmon processing facilities at Triton or nearby locations (i.e. fresh, frozen or smoking facilites) could be reached through a good highway network within 1-2 hours of either site. Although specific assessments relating to allocation of adults produced are not available, the terminal river fisheries could harvest and sell adults that could initially defray operating costs and eventually expand enhancement operations. For example, at Indian River the terminal harvests could account for up to 20% of the total production at the river sites leaving approximately 10% of the total production as brood fish to ensure continued stocking by the enhancement facility. Of course the common property inshore commercial and river recreational fisheries would be the most significant benefactors considering that those fisheries would receive 70% of the total enhanced production. Sales from the project's terminal fisheries would initially approximate 6,000 kg (i.e. gross sales $35,000-$60,000 dependent on product mix) with an eventual ultimate harvest as high as 25,000 kg (i.e. gross sales $150,000-$300,000 dependent on product mix). Undoubtedly a marketing study would also be desirable with the sponsors under special contractual agreements, which would ensure DFO inspection plus control of project operation, brood/harvest allocation, sales and distribution. DFO would solicit input of the Province of Newfoundland on such agreements considering the provincial jurisdictions in the processing, distribution and sales area.

E. Economic Considerations

1. Economic Rationale:

The concept of terminal harvesting is based on economic efficiency which argues that resources be used and allocated in an efficient manner. This means that waste must be avoided. According to the information presented in the Newfoundland Salmon Enhancement Discussion Paper, the present management regime for salmon will mean that after the commercial and recreational fisheries, some rivers (enhancement projects) will have more fish than are needed for brood stock requirements. Unless harvested, these surplus salmon constitute a waste of resource. Because the fish have already escaped the common property fisheries, they can be harvested at the terminal point of their migration (the enhancement facilities), and the revenue from their sale can be used to defray the costs of enhancement.

2. Incidence of Benefits and Costs:

Institution of a terminal harvest to defray costs raises the issue of cost distribution. Just as economic theory recognizes that under the principle of equity there should be a fair distribution of economic benefits, so too should there be a fair distribution of costs. The incidence of benefits should be reflected in the incidence of costs. At present, however, the federal government assumes liability for all costs of enhancement, but the benefits accrue to commercial and recreational fishermen and consumers. The terminal harvest is suggested as an attempt to permit those who incur the costs an opportunity to defray such costs, and in so doing, correct some of the imbalance between the incidence of costs and that of benefits.

3. Management Efficiency:

Another issue raised by consideration of terminal harvest is that of management efficiency. The particular management method suggested for enhancement projects (i.e. community groups) may lead to more cost-effective enhancement. Management control will be exercised by a group with an incentive to run a productive and cost-efficient operation - the incentive being the benefits to their community. Local people obtain employment on the project, there are increased returns to local commercial fishermen, and more local income is generated by recreational fishermen. Because such incentive exists, local management may be more effective than government management. This in turn means a greater flow of net revenues from the terminal harvest.

4. Potential Revenues:

Salmon enhancement projects have been identified based on the potential of a river to provide benefits to the common property

fisheries, not on the basis of whether or not there was potential for a terminal harvest to defray costs. Defraying of costs (either partially or wholly) is only possible for those projects which may have salmon surplus to fishery and brood stock requirements.

The Black Brook project appears to have good potential for a terminal harvest. The Newfoundland Salmon Enhancement Discussion Paper shows that the benefits to the common property fisheries from enhancement of Black Brook are positive (benefit/cost ratio: 1.27), and that in addition there is a potential annual surplus of salmon which can be used to defray the costs of the enhancement project. From the production and cost information given in the Discussion Paper, there is a potential revenue flow from a terminal harvest in Black Brook over a 25-year period as follows:

Black Brook:

Net Present Value Calculation			
10% discount rate over 25 years			
Salmon Value - $5.40/kg			
Present Value Costs:	Capital	$ 462,000	
	Other	595,952	
	Total		$ 1,057,952
Present Value Terminal Harvest			655,857
Net Present Value			($ 402,094)

As can be readily seen, the terminal harvest will not defray all costs on a present value basis. However, if capital costs are excluded, the net present value is positive ($59,905).

On a yearly cash-flow basis the Black Brook project can potentially defray its annual expenses after Year 5, with money remaining.

CASH FLOW - BLACK BROOK

Fiscal Year	Costs	Terminal Harvest Value	Net Cash Flow
	($)	($)	($)
1982/83	553,550	-	(553,550)
1983/84	49,400	-	(49,400)
1984/85	50,500	-	(50,500)
1985/86	63,000	-	(63,000)
1986/87	63,000	34,020	(28,980)
1987/88	63,000	68,040	5,040
1988/89	45,200	68,040	22,840
1989/90	45,200	68,040	22,840
1990/91	45,200	68,040	22,840
1991/92	45,200	68,040	22,840
1992/93	45,200	110,160	64,960
1993/94	45,200	145,800	100,600
2006/07	45,200	145,800	100,600
Total	1,701,250	2,525,580	824,330

By these calculations, the terminal harvest indicates recovery of all costs, with surplus revenue. Caution must be used in applying this data. Because of the time frame involved (25 years), the discounted values give a more realistic idea of the true costs and potential terminal harvest values of the Black Brook project. However, the cash flow presentation does give some indication of the amounts of revenue which may be available on a yearly basis once the project starts to realize a return of its enhanced stocks. It must be remembered that in some years more fish will be caught in the common property fisheries, or sea survival rates may be low, so that no terminal harvest is possible.

5. Application of Revenue:

The collection of revenues from a terminal harvest raises an important question: In what manner will the revenues be used to defray costs? There are three possible methods:

i) through the federal government's consolidated revenue account. Because the federal government incurs the costs of enhancement, it would receive any revenues to defray such costs. This method means there is no direct relationship between costs incurred and costs defrayed, i.e. revenues acquired will not be directly applied to costs.

ii) through the Department of Fisheries and Oceans. If the revenues go to the department for a salmon enhancement fund, the objectives of directly defraying costs can be realized. However, this may establish a precedent in that a department is earning revenues to finance its own projects, and is behaving more as a crown corporation than a line department.

iii) through the project managers (community group). If the revenues go to the project managers, again there is a direct relation in that costs are paid from revenues. However, a precedent is established in that revenue from a common property resource goes to a group which is harvesting in a unique fashion and has no historical right to that common property resource. Furthermore, the beneficiaries have not incurred the initial development costs.

All of this may be irrelevant if the province should intervene. The 1898 Privy Council constitutional decision confirmed that a province has the right to legislate with respect to property rights in its freshwater fisheries (e.g. who can own fisheries, how such fisheries can be owned, set and collect licence fees and resource rents, etc.). Since practically all of the issues raised by a terminal harvest are thus constitutionally under provincial jurisdiction, the provincial government has the power to decide who gets any revenue from a terminal harvest, and how such revenue may be used.

Another point is where the revenues are to be applied - to current costs, to past costs and/or to future development. It may not be possible to apply revenues to past costs (such as those costs funded by CEIC) unless the revenues go into the federal government's consolidated revenue account, in which case it can be assumed they are defraying past, present and future costs. Should the revenues go to the project managers there will have to be some mechanism for DFO voice in directing funds to future development. If the revenues are claimed by the province there will need to be an agreement between the two levels of government as to how revenues are to be used. If the revenues go to DFO they can be used in a salmon enhancement fund to defray current and future costs. Of course, availability of funds to defray future development costs can only occur if the terminal harvest is in fact large enough to defray current costs.

With respect to the above-mentioned federal-provincial agreements from discussions held during the 1980-1982 planning phase for the proposed 10-year enhancement initiative there was considerable provincial support shown for the project cost defrayal concept. The matter of revenue sources and usages from enhancement projects therefore warrants further federal-provincial consideration should the November 1983 Federal Cabinet Review prove favourable.

It is also important that any revenues should be used to defray enhancement costs, and not be utilized to incur further capital costs for processing facilities. There are numerous processing plants in Newfoundland at present which are operating below capacity, and could easily absorb any salmon which a terminal harvest might provide. The most cost-efficient method of disposing of the terminal harvest would be to sell the salmon en masse to the highest bidder, who would be responsible for slaughtering, transporting, processing and marketing. This relieves the project of all costs except those directly related to enhancement.

F. Harvesting Regulations

Current harvesting regulations have been developed in keeping with the concept of salmon as a common property resource. Regulations pertaining to the harvesting of salmon in the marine environment fall within federal jurisdiction; however, within inland waters, jurisdiction is divided between federal and provincial governments. In order to permit terminal harvesting of enhanced salmon stocks on a proprietary basis, the existing regulations will require extensive modifications. Such modifications and drafting of new regulations will require comprehensive consultations between federal and provincial authorities to ensure that all questions pertaining to river harvesting have been addressed. Moreover, it would be essential that the new regulations be specifically interpreted in terms/conditions within enhancement project agreements between the public sponsor and DFO wherever terminal harvests are to be prosecuted.

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