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Technical Report No. 19

The Public Regulation of Commercial Fisheries in Canada

Case Study No. 4

The Pacific Salmon Fishery

J. Douglas MacDonald
University of British Columbia

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J. Douglas MacDonald
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The findings of this Technical Report are the personal responsibility of the author, and, as such, have not been endorsed by members of the Economic Council of Canada.

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RÉSUMÉ

Cette étude de cas sur la réglementation de la pêche au saumon en Colombie-Britannique résume l'évolution des règlements appliqués dans ce domaine jusque vers le milieu de 1980. Elle divise toute cette période en deux phases distinctes. La première, où l'intérêt portait presque exclusivement sur la conservation des stocks, s'est caractérisée par la délimitation de zones et de périodes d'exploitation à accès libre, dans le but d'assurer aux divers stocks de saumon suffisamment de chances de s'échapper. Durant la deuxième phase, où la conservation des stocks demeurait encore un principe de gestion d'une importance primordiale, l'accent a été mis sur la nécessité de gérer les pêches en vue d'améliorer la performance économique des divers secteurs de l'industrie. Cette phase, qui a débuté par le programme de restriction des permis en 1968, se poursuit encore aujourd'hui.

Le succès de ce programme et la possibilité qu'il offre d'assurer la vigueur et la stabilité économiques à long terme de l'industrie constituent un thème central de la présente étude. La conclusion à laquelle nous arrivons comporte plusieurs éléments. Il semble évident que la limitation des permis a restreint, dans une certaine mesure, les investissements dans la flotte de pêche et qu'ainsi, face à la hausse rapide des prix réels dans cette industrie, les coûts d'exploitation ont été

maintenus à un niveau inférieur à ceux d'un régime d'accès libre. Mais il est évident aussi que cet effet de contrainte n'a pas été aussi marqué que prévu, et que des investissements trop nombreux et de double emploi dans des moyens de production ont contribué à réduire la richesse effective et potentielle de l'industrie. Le principal problème est venu de l'habileté avec laquelle les pêcheurs ont contrecarré constamment les efforts du gouvernement en vue de réduire les investissements excédentaires en biens d'équipement.

L'auteur conclut qu'améliorer le programme de limitation des permis, par l'application de règlements plus restrictifs visant les facteurs de production et leur remplacement, n'offrirait pas à long terme une solution aux problèmes économiques de l'industrie. La preuve est faite que de telles restrictions ne réussissent pas à diminuer les possibilités d'investissement et qu'elles ont une portée secondaire indésirable qui mène à la perturbation de l'ensemble des facteurs qu'utilise l'industrie. Les solutions à long terme devraient supprimer les motifs pour lesquels les pêcheurs sont portés à surinvestir, et non pas essayer de les restreindre artificiellement. A ce sujet, le moyen de gestion le plus direct et le plus efficace serait l'octroi de quotas individuels aux bateaux. Malheureusement, il serait difficile de le faire d'une façon directe à cause de la complexité de l'industrie de la pêche au saumon.

Le défi qui se pose donc pour l'avenir, sur le plan de la gestion, consiste à élaborer une stratégie permettant un système global de quotas individuels. À court terme, il faudrait mettre sur pied un programme de rachat financé par des redevances perçues sur les débarquements, expérimenter des systèmes de quotas par bateau selon les genres d'équipement employés dans des zones désignées, et intensifier les recherches relatives à cette forme de contingentement.

Summary

The case study on the regulation of the British Columbia salmon fishery summarizes the evolution of regulations in the fishery up until the middle of 1980. The study illustrates that there were two distinct phases in the regulatory history of the fishery. The first phase, concerned almost exclusively with conservation of the stocks, used area and time closures in an open access fishery in an attempt to ensure adequate escapement of the various salmon stocks. The second phase, while preserving stock conservation as a crucial element of the management rationale, emphasized the necessity to manage the fishery to improve the economic performance of the various sectors of the industry. This phase, which was initiated with the 1968 licence limitation program, continues today.

The success of the 1968 licence limitation program, and its potential to provide for long-term economic health and stability in the industry, are a central focus of the study. The conclusion is mixed. It seems clear that licence limitation had some constraining effect on capitalization of the fleet and so, in the face of rapidly rising real prices in the fishery, kept harvesting costs below the level that would have prevailed in an open access fishery. It is equally clear, however, that this constraining effect was not as significant as originally envisaged and investment in redundant fishing capacity has diminished both the realized and potential wealth in the industry. The chief problem has been the continued ability of fishermen to frustrate attempts by the government to cut-off investment in redundant fishing capacity.

The study concludes that further refinement of the licence limitation program, by the application of more restrictive input and replacement regulations, does not offer a long-term solution to the economic problems of the industry. It has been demonstrated that such restrictions are not effective in cutting off investment possibilities and have the undesirable side effect of distorting the input mix in the industry. Long-term solutions must remove the incentive for fishermen to over-invest and not attempt to artificially restrain it. In this regard, the most direct and efficient management option would be the introduction of individual vessel quotas. Unfortunately, the complexity of the salmon fishery mitigates the possibility of moving directly to an individual vessel quota scheme.

The management challenge for the future is to devise a strategy conducive to the comprehensive application of individual vessel quotas. A buy-back program financed by royalties levied on landings, experiments with vessel quota schemes for particular gear types in designated areas, and intensified research relevant to individual vessel quotas are recommended in the short-term.

1. Managerial Developments in the Salmon Fishery, 1870-1969 [1]

When salmon canning became feasible about 1870, the commercial salmon fishery began. It was the canning companies which developed the industry by investing in canning facilities and the boats and equipment necessary to supply these facilities. In return, these companies were granted exclusive canning and fishing rights over specified waters of British Columbia. Even by 1890, however, it was realized that management of the resource could not be left to market forces. In that year, time closures, mesh size and gear restrictions, boat limitations and license fees were introduced on the Fraser River. The motivation for such regulations was primarily to ensure an adequate stock escapement for spawning. By 1900 the Fraser River Canners Association attempted to regulate the number of boats in recognition of the unprofitability of competing for a catch share by investing in additional harvesting facilities. At this time each cannery license permitted the use of 20 fishing vessels. In 1908 the canners implemented a boat allotment scheme for northern waters which was taken over by the Province in 1910. The year 1908 saw the first limitation of licenses for canners in Northern waters of British Columbia.

This period of the fishery was somewhat unique in that the regulatory process was confined almost entirely to considerations about the conservation of the stock. After granting exclusive rights to a limited number of canners, government authorities appear to have initially left the management of the fishery in the hands of the canners. Despite attempts by these canners to rationalize fishing operations by cooperative controls on effort, it became necessary for the government to impose restrictive regulations for conservation purposes.

The year 1912 saw the government begin to impose regulations on the fishery for purposes other than conservation or the economic health of the fishery. In that year the government apportioned a number of licenses to independent, white fisherman in order to induce them to settle the northern part of the province. Following the First World War, the government dropped the program of license limitation for canneries and granted them licenses wherever practical to provide employment for returned servicemen. It seems clear that the use of the fishery to meet such socio-economic objectives exacerbated the economic and biological ills of the industry.

Despite the government action at this time, there is evidence that it was at least aware of the economic implications of their actions. The Sanford - Evans Commission, one of many in the early 1900's, clearly pointed out the desired role of the government in the fishery from an economists' point of view. Part of the report states:[2]

> It is clear public duty not merely to conserve the supply of salmon in its present proportion, but to increase it until each year it reaches the <u>economic</u> maximum and it appears to us equally clear that all the conditions surrounding the industry should as far as possible be stabilized and <u>the excessive use of capital and labour obviated or prevented</u>... The solution of this problem would not seem to be found in encouraging or permitting the employment of more

> capital or more labour than can efficiently perform the work. The public interest can be served in other ways... If the cost of production becomes too great all hope of advantage to the public as consumers will disappear.

The Federal Government did not act on this report but in anticipation of acting on it raised license fees and taxes within the fishery in 1919. By the mid-1920's, however, the government again lowered license fees and removed license restrictions on canneries.

In 1927, several years after the decontrol of the industry, the industry had a disastrous year. It was claimed that the additional gear which entered the fishery as a result of decontrol in the early and mid-1920's was a factor in the poor run of salmon in 1927 and the losses incurred by canners and fishermen. Committed to free entry in both sectors of the industry the government began to impose increasingly restricitve area and time closures in the fishery. In 1927, according to Cicely Lyons "The ordinary weekly restricted periods were extended, all salmon fishing areas were closed for seven consecutive days during the runs with a further three days in some sections, while an earlier than usual closure of the fishing season was enforced."[3] Such regulations were made increasingly restrictive in 1929, 1930 and in subsequent years with the rising value of salmon and the increasing capability of the fishing fleet.

The reaction of canners to this series of events was interesting. The following passage from a brief sent to Ottawa by the canners illustrates this:[4]

> Although the Federal Government limit (sic) the number of fish to be taken each season, adjusting the quantity by closed periods, their present policy is nevertheless to issue an unlimited number of fishing licenses to all qualified applicants. So long as this policy remains in force it will be difficult, if not impossible, to limit the number fishing in each area to the figure set for conservation, and consequently additional closed periods are imposed.
>
> The Canners are of the opinion that there are already too many plants in existence and the only way the present state of affairs can be remedied for the benefits of Canners and Fishermen alike is to limit the number of canneries as well as the amount of equipment to be used. This policy is not new but is the original method of control in force prior to 1912 and is very strongly recommended by each of four special Fisheries Commissions between 1905 and 1917.

Secondly, the principal cannery operations entered into a co-operative arrangement and agreed to set gear allowances and the amount for use in each of the 17 fishing areas existing at that time. Several such agreements among processors were made but the lack of sufficient barriers to entry in both sectors of the fishery mitigated the success of these ventures.

Finally, as a result of the disastrous 1927 season, B.C. Fish and Packing Co. Ltd. and Gosse Packing Co. Ltd. merged to form B.C. Packers Ltd. and in 1928 had 44 canneries and 112 large power vessels. The first move of this large company was to close 8 canneries. These mergers and the rationalization of the canning sector represented the industry's response to the new conditions faced by the canners. The processing sector began its development to its present form.

From the early 1920's onward the government continued to regulate the fishery based on stock conservation principles. The primary aim of the regulations was to allow adequate spawning escapement while a secondary purpose was to allocate the catch between each of the three gear types. The actual regulatory tools used to achieve these goals were area and time closures. But beginning in the early 1950's, increased pressure on the resource led to a much more stringent application of these closures. For example, the average days per week fished in the Strait of Juan de Fuca fell from 5 1/2 in 1951 to only 3 1/2 in 1959.[5] The reason for this is highlighted in a statement by Skeena Salmon Management Committee in 1956;

> "From 1944 to 1950 the fishing operated throughout the sockeye season on a 2 day weekly close time... With the 2 day weekly closure, the rate of exploitation was only around 50%. Thus the present day fishing operating with one more closed day a week (i.e. weekly closed period of 3 days) removes 15% more of the stock than did the fishing of the earlier years."[6]

It is clear that more effort per unit of time being applied in the fishery was frustrating management attempts to ensure adequate escapement.

With more and larger vessels engaged in the fishery for increasingly shorter periods of time, it was becoming obvious that a problem existed in the industry. Not only was it obvious that biological stock management was becoming increasingly difficult but the works of fisheries economists in the mid-1950's, questioned the biological basis for stock management. The 1954[7] work of H.Scott Gordon showed that the fishery, being a common property resource, would not result in economically efficient fishing with free entry and too much effort would be employed in the fishery. The groundwork was laid for ways to manage the fishery on economic grounds.

In 1958 Dr. Sol Sinclair, an economist, was commissioned to conduct a study of the salmon and halibut industries to deal with the following problem:

> "The licensing policy of the Department has restricted the fishery to Canadian citizens but otherwise licenses are issued freely. The fishermen's Union has pressed strongly for a more restrictive policy but obviously this is not an easy solution against a background of freedom of entry into the industry. Restriction on efficient gear and vessels would lead to still higher costs in an already high cost industry. Relaxation of conservation measures would destroy the fisheries."[8]

In brief, Dr. Sinclair's major recommendations were that restrictive licensing and a license fee system be established in the industry. Although implementation of these regulations were delayed for ten years, finally, in 1969, a license limitation program was brought into being.

Table 1.1 Average DAYS per Week Fishing in Juan de Fuca

Year	Average DAYS Fished
1946	5
1947	5
1948	5
1949	5
1950	5
1951	5 1/2
1952	5
1953	5
1954	5
1955	4 1/2
1956	4
1957	3 1/2
1958	4
1959	3 1/2

Source, <u>The Sinclair Report</u>, 1960, P.25.

2. Management Programs in the Salmon Fishery, 1969-1980

This section of the salmon case study provides a general overview of the license limitation program and other managerial developments in the salmon fishery since 1969.[9] Analysis of the management of the fishery is left until the next section of this report entitled "Evaluation of Salmon Management".

With the appointment of a new Minister of Fisheries under a majority Liberal government in 1968, the recommendations contained in the Sinclair Report of 1960 were finally acted upon. In the fall of 1968, the Minister announced a new salmon licensing system. Subsequently, beginning in the 1969 season, a new management plan (known as the Davis Plan) was implemented in the salmon fishery. The plan would consist of four phases.[10]

Phase I - The initial phase of the program was designed to freeze the number of vessels engaged in the industry. This was accomplished by creating two classes of salmon licenses to replace the general fishing license previously in force in the fishery. An "A" or "B" license was issued to vessels based on its salmon landings in either 1967 or 1968.[11] Vessels achieving a set level of production in both salmon and non-salmon fisheries could acquire an "A" or "B" license. For vessels in the salmon fishery, production of 10,000 pounds or more of pink or chum salmon (or an equivalent amount of other salmon species) was required for the acquisition of an "A" license. Vessels which did not achieve this level of production during either 1967 or 1968 were issued "B" licenses. No more "A" or "B" licenses would subsequently be issued. In addition, while a vessel with an "A" license could be retired and replaced with a new vessel, vessels holding "B" licenses could not be replaced. Licenses were transferable and the license fee charged was increased from $5 to $10. An Appeal Committee was established to hear complaints of those who did not qualify for a license under the program. Finally, the number of vessels owned by companies was fixed at its 1969 level to prevent companies from accumulating "A" licenses.

Phase I of the Davis Plan attempted to freeze the number of vessels in the salmon fleet and affect a gradual reduction as "B" vessels were retired.

Phase II

Phase II of the Davis Plan was designed to reduce the size of the salmon fleet. The major mechanisms to affect this reduction were the implementation of a "buy-back" program and the phasing out of "B" class licenses created under Phase I of the program.

Under Phase I of the Davis Plan vessels with "B" licenses could not be replaced if retired from the fishery. Phase II of the program called for the phasing out of all "B" licenses within a ten year period. This strategy was designed primarily to respond to fishermen's complaints that part-time and casual fishermen should be elimininated from the fishery. Since these vessels accounted for a very minor portion of total fleet production, their elimination would do little to increase the production and incomes of the remaining fishermen. It would, however, eliminate a pool of reserve vessels that could have become full-time salmon operations if more favourable conditions developed in the fishery.

The "buy-back" program involved the government buying vessels from fishermen on a voluntary basis. The fishermen had the choice of selling their vessels to the government or selling them on the open market.[12] The program was to be financed by increases in license fees on vessels holding "A" licenses. By 1971 the fees were $200 for vessels under 15 net tons and $400 for vessels 15 net tons and over.

Phase II of the program also amended the replacement rule for vessels holding "A" licenses. Under Phase I, "A" vessels were replaced on a boat-for-boat basis.

It was discovered, however, that the 76 vessels retired in the first year had a total capacity of 187 tons but were replaced with vessels having a total capacity of 596 tons. The boat-for-boat replacement rule was therefore changed to a ton-for-tone replacement rule. Phase I of the program held company ownership of vessels at their 1969 level. With the fleet decreasing in numbers, however, it was decided that companies should decrease their fleet size at a rate paralleling the shrinkage of the total fleet. Finally, special provisions were adopted to mitigate hardships caused by these measures to Indian fishermen. These provisions are described in the section of this report entitled The Native Indian Fishery.

The "buy-back" program was terminated in 1973 due to the sharp rise in the price of vessels on the open market and the limited funding base for the buy-back program.[13] In the end, 354 vessels (or 7% of the fleet) were bought back under the program accounting for about 5% of total fleet production. The $5.8 million cost of buying these vessels was covered partly by revenues received from the auctioning of the retired vessels and partly by the revenues from license fees.

Phase III - Phase III of the program was aimed at maintaining the quality of the delivered salmon product and improving vessel standards. This program, implemented in the 1973 season, and applied to the fishing industry as a whole, implemented 1967 regulations set out in the "Inspection Act" but never enforced. Vessel standards[14] were set to provide minimum requirements for vessels catching and transporting fish. Non-compliance with these standards meant the cancellation of vessel licenses. A significant number of licenses were cancelled in the first year of the program (about 160) but vessels could be upgraded and presented for re-inspection.

Phase IV - Phase IV of the Davis Plan was never implemented. It was intended to revise the area and time closure regulations that had evolved in an ad hoc manner to ensure adequate escapement and an acceptable distribution of catch for each gear type. These regulations reduced fishing efficiency of the fleet as a whole and it was hoped they could be revised to reflect economic criteria. Phase I and II of the Davis Plan, it was hoped, would reduce pressure on the stocks and increase the production of remaining vessels sufficiently to permit a re-shaping of these regulations. By 1973 it was clear that fishing pressure on the stocks had not been significantly reduced. In addition, Phases I and II did not generate the information necessary to revise the regulations on economic grounds. The relative efficiencies of the various gear types, a pre-requisite to redesigning the area and time closure regulations, was unknown.

Another major managerial development in the salmon fishery was the Salmonid Enhancement Program. The concept of the program was announced in 1975 and the first five-year phase of the program was announced in 1977.[15] The first phase of this joint federal-provincial program has an estimated cost of $150 million and an objective of increasing salmon production by 50 million pounds per year by utilizing such enhancement techniques as the provision of hatcheries, spawning channels and fishways. Depending on the results the first five-year phase of the program, Phase II could be designed to raise future production by 190 million pounds per year over its present level.

An increase in salmon production, however, is only a step to achieve other government goals for the program. These goals are diverse ranging from increased employment to the generation of additional rents in the industry. It is the potential of the program to increase the net benefits to society from the resource that is of interest here.

Large public expenditures are associated with the program and one objective of the program was to recover these costs from participants in the fishery that would benefit from enhancement. This included participants in both the commercial and sports salmon fishery. The mechanism proposed to recover costs in the commercial sector was a small tax on the value of salmon landings while a personal license fee was proposed for recreational fishermen. As of June 1980, no action has been taken to recover costs although both a landings tax and a license fee could be implemented in the near future.

A serious concern of the program is that the potential benefits of the program not be wasted by additional investment in redundant harvesting and processing facilities. Pointing to the increase in the number of new vessels replacing old vessels as a result of a large 1973 catch the publication outlining the program concludes; "In order that potential resource rents from enhancement not be dissipated by over-investment, it will likely be necessary to devise further methods of control"[16]. The publication also expresses concern that processing facilities will also expand unnecessarily. What seems clear is that to maximize the net benefits of the Salmonid Enhancement Program additional management programs are needed to induce efficient investment behaviour in the industry. "If investment takes place regardless of requirement, then while the potential net benefits from enhancement would not be reduced, the <u>actual</u> benefits would be, as the over-investment dissipated the resource rents".[17]

3. Evaluation of Salmon Management

The Pacific salmon fishery is probably the most studied of all fisheries in Canada. This is partially due to the innovative license limitation program introduced in 1969 and partially because the potential benefits from a rationalized fishery are larger than in any other fishery in Canada. There are two reasons for this. First, the value of landings of Pacific salmon in 1978 was about 158 million dollars, more than twice the value of the next leading fishery, the lobster fishery, worth 75 million dollars in 1978. Second, because the salmon is an anadromous, schooling fish, it could be harvested at a very low cost relative to its potential revenues.

The problem which has inspired so much research into this fishery, is that much of the potential rent [19] that could be reaped is lost in the unnecessary costs of excessive harvesting and processing facilities. The reason for this excess lies, as with the other fisheries in this study, in common property. In this condition, the harvesters do not gain from making investment decisions which minimize costs.[20] The exact extent of the resulting over-capacity in the fleet is not known at all accurately but all previous studies suggest that it is at least several times the minimum level necessary to harvest the resource. In 1969, the then Minister of Fisheries, Jack Davis stated, "We are overequipped, I am told, by a factor of two or three." [21]

Government regulation did not create common property, and so one cannot automatically impute the excessive investment mentioned above to regulation or government action. Nevertheless, the power to regulate the salmon fishery was early perceived as creating an opportunity not only to save the fish but also to modify or prevent fisherman over-investment, and so capture rent that would otherwise be lost. How effectively was this regulatory opportunity to gain economically grasped? At the same time, we must ask how great was the cost of administrating the regulatory regime? A crucial point to remember is that attempts by government to design regulations to increase the economic efficiency of the fishery are a recent development; perhaps only in the last 11 of the industry's 110 year commercial history has efficiency even been officially recognized, let alone attempted by management. In the following analysis of their success, therefore, we should keep in mind that the approach to managing the fishery is in its infancy, and is pursued in the context of a fishery with long established traditions and vested interests.

Thus, increased economic efficiency has not been the only salmon management goal. Other goals, most importantly conservation of the resource, inspired government intervention in the fishery.

The need for government regulations to prevent the commercial extinction of salmon runs has been a long recognized fact in the fishery. The high value of salmon and the relative ease of capture gives rise, through the common property problem to significant over-mobilization of catching power; a serious threat to the very survival of the stocks. Hence, much regulation of the fishery (up to 1969) was designed to ensure the survival of these stocks in the face of intensive and increasing fishing effort.

The primary mechanism used to promote adequate escapement of a spawning stock has been closures of the fishery, for a specific time period, in a specific area. As put by G. A. Fraser, "Over the years closed seasons, closed areas and restrictions on more efficient gear were all used in an attempt to restrict the catch to a biological sustainable maximum".[22] That these attempts have been successful is illustrated by the constancy of landings through the years despite a high and rising amount of effort directed at the stock.[23] (Research done for the Salmonid Enhancement Program, however, predicted that, in the absence of enhancement, catches would decline by between 20% and 30% from their current level by the year 2007.)

There are major qualifications to any success in preserving salmon stocks. One of the most immediate is the cost it has imposed on the federal government which implements and enforces regulations. It has been estimated that in 1977 salmon regulation cost the government about $20 million, more than 10 percent of the landed value of the catch. High as this percentage is, it is probably still increasing as the capacity of the fleet grows with the rise in the real value of salmon, making it become increasingly difficult and costly to ensure adequate stock escapement. As the margin forerror in on-line stock management has been diminishing, worried officials increase their administrative safeguards.

Even prior to 1969, there was serious concern that salmon fishing might make no positive contribution to the Canadian economy. With open access much of the rent from the industry was dissipated. In addition, substantial expenses were incurred by the government in administering regulations to ensure adequate stock escapement. This led Pearse and Wilen to state:

> "The meagre returns in the fishery before restriction of access is documented by Campbell (1971). In view of subsidies and transfers to the fishery, and the significant costs of public management, the net social gain in this condition of long-run equilibrium was almost certainly negative"[24]

A historically important management objective in the fishery has been to maintain the share of each gear type in the total catch. This has been done by varying time and area closures across gear types in an attempt to allocate a given share of the catch to the three gear types. Since 1960 the proportion of the catch accounted for by each gear type has been relatively stable although the share of landings for trollers has increased by about 10% while that of gillnetters has decreased by a similar amount.[25]

The use of area and time closures to ensure adequate escapement and to allocate the catch across gear types has costs additional to those of direct management. Of primary concern is the distortion in investment decisions in the fishery. While their investment decisions would not result in least cost harvesting in an unregulated fishery, the imposition of area and time closures have induced fishermen to adjust to the reduced fishing time available by increasing the fishing-power of their vessel. Additional capital and labour were steadily substituted to replace the constrained input "time" until it was no longer profitable to do so. Furthermore, the regulations are not neutral across gear types. Seiners are more heavily restricted than gillnetters and gillnetters more than trollers.[26] This makes the determination of the relative efficiencies of each gear type impossible and raises concerns that the fleet mix is distorted.

A second government concern in the fishery is employment. This implicit goal has, in the past, been at the root of government policy toward the fishery. The relative bias of regulations in favour of labout-intensive troll vessels and against the more capital-intensive seine vessels is an illustration of this.

A host of special concerns also enter into government goals for the fishery. The most important of these is Indian participation in both the food and commercial fishery. Another is the maintenance of a fishing fleet independent from processor and company domination or ownership. Regulations designed to achieve efficiency aims can sometimes have adverse and unpredictable consequences for special interest groups such as Indians, and may have to be modified to minimize such an impact. The original 1969 license limitation program, for example, resulted in significantly increased entry costs which imposed special problems on Indian fishermen. The program was subsequently modified to ease the participation of Indians by making concessions to their special problems and rights.

While it is essential to recognize the diverse aims of the government acting for its citizens for regulation of the fishery, it is equally important to remember that the achievement of most of these goals is predicated on the extraction of wealth from the resource. The pursuit of individual short-run goals, at the expense of a lower extraction of wealth, may be detrimental to the attainment of all of them in the long run. It can be said, therefore, that the extraction of maximum rent from the industry, although it received little attention until recently, is the key to, if not the criterion for, a healthy fishery. This fact became clearly recognized after the 1950's crisis period in the fishery. The vessel licensing system as introduced in 1969 was the first major attempt to regulate common-property salmon harvesting on primarily economic principles - perhaps the first for any sea fishery in the world.

The license limitation program has been exhaustively described [27] in many reports and is not dealt at length with here. For our purposes it will be sufficient to list the goals set out for the program and describe the major regulations designed to achieve these goals.

The goals of the license limitation program as summarized by Dr. Sol Sinclair [28] ten years later were as follows;

"1) To reduce the salmon fishing fleet so that the remaining vessels could be more efficiently utilized.

2) To reduce capitalization of the salmon fishing fleet.

3) To increase the net earnings of the salmon fishermen.

4) To provide the opportunity for government to obtain economic rent from the salmon fishery.

5) To provide the basis for improved conservation techniques."

As described in Section 2 these goals were to be pursued by a management plan consisting of four phases. It envisaged a carefully staged move toward increased efficiency through fleet control and reduction followed by the revamping of the area and time closure regulations to reflect economic efficiency criteria. (For a variety of reasons,[29] Phase IV of the program was not implemented. The analysis of the 1969 management plan is, therefore, an analysis of an incomplete program. What is really being evaluated are Phases I and II dealing with license restriction and reduction through the involuntary retirement of B licenses and voluntary license retirement through the buy-back program.)

The general question on which the success of the license limitation has been evaluated is the following; did the license limitation program reduce capitalization of the fleet and result in a more efficient utilization of the remaining vessels? There are two ways to interpret this question:

(1) The question could be interpreted literally entailing comparisons of capitalization and efficiency before and after the program was implemented.

(2) Rather than comparing absolute levels of capitalization before and after the program, capital growth rates could be compared to the growth of fleet revenues to ascertain if the program resulted in a slowdown in capital growth.

Before using data from the fishery to evaluate these concerns, it is useful to revert to economic theory to see what implications would be predicted from a license limitation and reduction program. Theory tells us that it is possible to minimize fishing costs by imposing restrictions on the level and combination of inputs the catchers may employ. Many difficulties arise with such an attempt, however. In the salmon fishery, for example, the relative efficiency of the various gear types would have to be measured.[30] The optimal combination of inputs for the most efficient gear type would subsequently have to be determined. The knowledge of costs, prices and stocks necessary to these calculations would have to continually updated to respond to changing conditions in the fishery. Secondly, to be effective, all dimensions of effort must be effectively constrained at the minimum cost level. If not, as already noted, inputs will be substituted so that total non-substitutability of inputs is required for complete program effectiveness. Note that the degree of substitutability appears to vary widely among fisheries. This implies that the use of input or effort restrictions (in combination with other regulations) may make sense in one fishery, say lobster, but not in another, say salmon or herring.

The strategic problem of the salmon fishery manager is to isolate a single input or set of inputs by which he can effectively constrain total effort. In the lobster fishery, fisheries' managers, by restricting only the number of traps, may come close to controlling all effort. With salmon however, the manager is faced with innumerable possibilities of circumvention,for fishing intensity can be adjusted by changes in the power of the vessel, use of location gear,resorting to combination vessels and by a more intensive use of time. The baffling problem is to control all dimensions of effort by controlling only a few key inputs.

Technological advance poses further problems. In the past the use of new technology has been banned in many fisheries, leading to higher than necessary fishing costs. As summed up by Fraser:

> "The number of factors that define a vessel's catching capacity is infinitely large, and this type of regulation to be effective must eventually control all of these factors. The addition of one or two constraints may have a beneficial short-run effect,

but in the long run new loopholes will arise. The inevitable result would be an ever expanding set of regulations of dubious value".[31]

Having taken this rather pessimistic abstract view of input controls, we turn to the actual license-limitation program. A policy of limiting and subsequently decreasing the number of fishing vessels would be justified if a "vessel" was a rough measure of a standard amount of effort. If this were the case then Sinclair's objectives 1) and 2) would be met, as the number of vessels decreased over the 1969-1977 period from 6932 to 5300. However, the vessels extant in 1977 were larger, faster, more versatile and more highly capitalized than those in 1969, so that the "vessel" was not a satisfactory unit.

Indeed, Dr. Sol Sinclair in his 1978 report estimated that real capital employed in the fishery rose between 35% and 47% between 1969 and 1977. This capital accretion came about in several ways:

(1) In the first year of the program small vessels could be replaced by large ones. For example, by June 1970, 76 vessels were retired from the fishery and replaced with vessels which had a combined tonnage of about three times of the original vessels.

(2) After the subsequent initiation of a ton-for-ton rule, several small vessels could be retired and replaced by one large vessel with a tonnage equal to the combined total of the smaller ones, but a higher real capital value and greater fishing power.

(3) Despite the overall decline in the number of vessels from 1969 to 1977 the number of combination vessels rose dramatically for all gear types.[32] Real capital employed by combination gear vessels rose by between 158% and 186% according to Sinclair's estimates.[33]

(4) All categories of vessels increased the use of electronic equipment and the level of horsepower of their vessels as described in the appendix of this report.

Along with the decrease in the number of vessels there was a decline in the numbers of individuals employed in the fishery. In 1969, 8912 individuals were employed in the fishery compared to 8111 in 1975. Estimates of the number of man-days fished, however, showed a more limited decline over this period. If the opportunity cost of labour per unit did not rise substantially over this period, it would be safe to conclude that the real costs of labour did not rise.

While the quantity of capital employed in the fishery was larger in 1977 than before license limitation was imposed, it is useful to try and answer the second question above to ascertain whether or not license limitation had any constraining effect on capital accretion. Pearse and Wilen [34] tried to discern if there was any difference in capital growth between the periods 1957-1968 and 1969-1977. Using regression techniques they estimated capital had an average annual growth rate of 5.7% prior to 1969 and 3.7% after that date. This occurred despite an estimated constancy of fleet revenues over the entire period. They concluded: "This is admittedly rough evidence suggest that the fleet rationalization scheme has been partially successful in checking the expansion of capital engaged in the fishery". [35]

Analyses of the license limitation program have come to a mixed consensus on its efficacy in reducing capitalization and inducing efficiency. Cyclicality and changing economic condiditions in both the salmon fishery and closely related fisheries have complicated evaluation of the program. On the positive side, perhaps the most encouraging sign of success has been the emergence of significant values for salmon licenses[36] that have remained high over the life of the program. Such positive license values indicate that rents are emerging in the fishery and not being entirely dissipated in new investment. Even this measure must be interpreted carefully, however, as unrealistic expectations (due, for example, to the Salmonid Enhancement Program) and short-term economic conditions may bias their measurement of long-term rent in the industry. The persistence of high license values over a reasonably long period of time, however, are an encouraging sign.

The short-term success of the program has been largely attributed to the buy-bac program. This program, which ran for a three year period, retired 350 vessels representing about 5% of total fleet production. It was during this period that significant rents (as measured by the estimated value of licenses) began to emerge in the fishery. The buy-back program was terminated in 1973, however, as the program, with its limited funding base, could no longer be competitive in the market in bidding for licenses.

The buy-back program suffered the same problem as the license limitation program generally. There was no effective tool with which to appropriate any rent accruing from the program. License fees generated some revenue but remained at a low level. In the short term the result was a rise in the value of a license as rents emerged in the fishery. In the long term, it would be expected that much of this rent would be dissipated in redundant capital. As will be discussed later if a tax system were combined with the buy-back program much better results could be expected.

Success of the program must be termed limited, however. For one thing, pressure on the resource has remained high. The ad hoc area and time closure regulations that built up in previous years have had to be maintained and more stringently enforced. At the outset of the program it was anticipated that these regulations, which cause inefficient and distorted investment behaviour, could be modified to reflect economic efficiency criteria. Fishing pressure has not been reduced sufficiently to permit this. As put by Dr. Sinclair in his 1978 report; "It was felt that with fleet reductions the more obvious detrimental effects of these regulations could be eliminated or at least adjusted. This was not happening."[37]

Furthermore, rent extraction through license fees has remained insignificant, especially when seen in light of the huge expenditures made by the government to manage the fishery.[38] The last increase in license fees was in 1971, and since then salmon license revenues as a percentage of total resource landed value have fallen from 2.4% to under 1%. It is clear that while fishermen holding licenses in 1969 may have benefited from the program through increased earnings and windfall gains from the sale of vessels and licenses, the government has been a net loser. Additional costs of establishing and monitoring the program, compensating fishermen selling out of the industry and insulating certain groups from the more adverse impacts of the program[39] have not been matched by increased revenues from the fishery. For example, from 1970 to 1973 all of the revenues derived from license fees was spent to buy-back retiring vessels.[40]

The crucial point is that the investment behaviour of fishermen in the common property salmon fishery did not lead to least cost harvesting of the resource. The license limitation and buy-back program were designed to decrease harvesting costs by restricting and reducing the number of vessels participating in the fishery. It did not, however, effectively constrain fishermen from increasing fishing costs (i.e. by investing in redundant capital). Thus, the cost saving achieved by fewer vessels participating in the fishery was largely lost as the capital value of the remaining vessels increased.

This conclusion has serious implications for the Salmonid Enhancement Program begun in 1977. The first phase of this Federal-Provincial program alone has been estimated to cost $150 million. The purpose of the program was to augment salmon stocks and prevent future predicted deterioration of the stocks. Such action will, in the words of the Program's Information Branch "... greatly improve the efficiency of the industry, assuming that additional capital inputs will be disciplined".[41] The problem is that there is no mechanism to prevent the application of increased effort in the fishery as a result of enhancement. In fact, although a tax on the value of landings in the commercial fishery and license fees in the recreational fishery have been proposed to cover the costs of the program, no concrete action has been taken on these proposals.[42] Cost recovery would enable the government to recapture its investment in the fishery but unless further action is taken to rationalize fishing operations the returns of this government investment to the industry will be minimal.

The license limitation program was a useful beginning. It helped identify the fleet so that management of and planning for the fishery could be carried out in a more informed manner. It is obvious, however, that before any serious move toward economic efficiency can be made supplementary regulations are needed. There are two basic alternatives:

(1) A tax or fee system which would enable the government to extract rent from the industry and modify investment behaviour.

(2) A property rights system.

4. Evaluation of Alternatives

The alternatives evaluated here assume that the current emphasis on economic efficiency in the fishery will continue and grow in future years. It is clear that the license limitation program, by itself, has limited potential to bring about further increases in economic efficiency in the industry. If the present system is maintained it can be expected that, given rises in the real price of the resource, increased pressure on the resource will necessitate more stringent area and time regulations or more stringent (and costly) enforcement of the present ones. Economic waste will persist and grow and biological stock management will become increasingly difficult and costly.

The major problem with the license limitation program was that it did not reduce the incentive for the fishermen to overfish. It attempted instead to reduce over-investment by directly restricting effort while leaving the incentive to expand effort intact. The fishermen respond to such incentives by devising ingenious but costly ways to frustrate attempts to limit the amount of effort they direct at the stock. As was mentioned above there are two basic ways to correct the incentive to over-invest - a taxation scheme and a property rights scheme.

It must be realized right at the beginning that both of these schemes represent a major departure from the status quo in the industry. In fact, any scheme that is serious about achieving significant increases in efficiency, will, in the long-term at least, result in a fleet size and structure different than that prevailing in the fishery at present. Despite the obvious need for a new management scheme and the equally obvious benefits that could result from an effective scheme, a cautious approach should be used in devising and implementing a management program. Any new program must be cognizant of the following points:

(1) Rationalization necessarily implies dislocation of capital and probably labour from the fishery. While it is not possible to ascertain the relative efficiencies of various gear types and groups, it is certain that some will be harder hit than others. A new program must allow for compensation or incentives for individuals to leave the fishery and allow a smooth adjustment to a more efficient fishery. Besides being socially desirable such an approach is undoubtedly a political necessity.

(2) Evidence from the 1969 license limitation program suggests that the maintenance of a fleet independent of company control is a high priority in the fishery. Companies and individuals with easy access to capital may have an unfair advantage in acquiring vessels or rights to fish if capital markets are not functioning properly. Social acceptability may dictate some mechanism to prevent concentration of licenses or property rights in the hands of specific interest groups.

In any event, the management scheme should be designed to minimize any negative impact of poorly functioning capital markets.

(3) Considerable socio-economic research should preceed the proposal of a new management plan. Such research should attempt to isolate potential administrative problems and the distributional impacts of the new program. At the present time, there does not seem to be enough information available to researchers and managers to ascertain all of the economic and social consequences of imposing either new type of management program. Since both taxation and property rights systems are novel approaches to fisheries management, careful and detailed explanations of their functionning and goals should be presented to fishermen. One approach would be to initiate the program in a small area before proposing a more widespread implementation.[43] This approach would provide data on the actual dynamics of

the program and would, if the program turned out to be successful, have a positive demonstration effect on fishermen in other areas. For example, the buy-back program implemented in the east coast lobster fishery was introduced first on an experimental basis, in Prince Edward Island. The success of the program brought demands for its implementation for lobster fishermen in other areas of the Maritimes.

(4) The salmon fishery is composed of two important parts - the commercial fishery and the sports fishery. Both sectors utilize the same stocks of fish and the appropriate maximization of net benefits from the resource should be over both sectors. The ad hoc evolution of regulations in both sectors results in a haphazard allocation of the stock between the two competing uses. Regulations designed to induce efficiency in the use of the common stock in one sector must be complemented by appropriate action in the other.

(5) The impact of any salmon management program on fisheries other than the salmon fishery should be discerned as fully as possible and measures should be taken to coordinate the management plans of various fisheries. For example, if vessels and labour were displaced from the salmon fishery they would gravitate to fisheries where entry was not restricted, lowering returns in that fishery. What this is really calling for is an integrated management program over the whole fishing region.

(6) Any management program should work towards obtaining a greater balance between government expenditures in the fishery and revenues derived from it. Application of this philosophy, already embodied in the Salmonid Enhancement Program, requires that entry be limited.

(7) Variations in prices and resource availability have been significant in the salmon fishery. A management plan must be flexible enough to respond to variability in incomes without jeopardizing escapement and recruitment.

Given these points, it is necessary to attempt to spell out the working, merits and problems of the two alternative management strategies - taxes and property rights.

a) Taxes

There are two forms that any tax system would take: license fees or landings taxes. Both taxation methods would decrease the incentive for fishermen to over-invest by extracting rent from the industry. A license fee is an input tax while a landing tax is, of course, an output tax. Aside from the efficiency effects of either scheme, both are sometimes advocated to at least enable the government to cover its costs in the fishery. While a significant extraction of rent undoubtedly would represent an improvement over the current situation, it should be viewed as a very minimal goal by fisheries managers.

The greatest advantage of a license fee system is that it is already in place in the fishery and would only have to be updated from the 1971 level at which it is now set. A license fee system has problems endemic to any taxation scheme. A lot of information would be required to set and maintain the fee at an optimal level. At the same time, however, changing license values could be used to monitor whether the level of the fee is set too high or too low. License fees share many of the problems of landings taxes that will be described below, but they have some additional limitations:

(1) The present license fee structure was established in the 1971 season, and included three levels of fees - $100 for vessels less than 30 feet in length, $200 for vessels greater than 30 feet but less than 15 tons and $400 for vessels 15 tons or greater. Such a structure raises both efficiency and equity problems which would be magnified if fees were raised to generate larger revenues for the government from the fishery. From any efficiency point of view, the two-tiered fee system tends to distort investment decisions as fishermen attempt to minimize the licence fee per vessel ton. For example, under the present system (if the fees were signigicant)one would expect a cluster of vessels at the 15 ton capacity level and greater capital (fishing power) per ton. Regarding the equity of the fees, it is clear that since fees are not related to landings low volume producers in each vessel category suffer a greater burden from the fees than do high volume producers.

(2) The lack of a relationship between license fees and landings has another serious problem. Although very high license fees would undoubtedly force vessels out of the fishery, they do not raise the marginal cost of fishing in the short run. While in the long run an appropriately specified fee system could result in efficient fishing, its short run impact on effort is much less clear. In particular, it would be a particularly unwieldy instrument for affecting intraseasonal adjustments in effort.

The conclusion is then that, while moderate increases in license fees could be useful to extract some additional rent from the fishery, their use as a major management tool is not recommended. While high license fees would reduce the number of vessels and the total amount of effort in the fishery their drawbacks are too great. Efficiency loss would occur through distortions in the fleet and equity problems would arise. In addition, as with landings taxes, license fees would not facilitate precise stock management.

A second, more promising taxation scheme, would be a landings tax. Note that a tax on the value of landings has been proposed to recover the costs of the Salmonid Enhancement Program. Dr. Sol Sinclair in his 1978 report proposed that a taxation scheme, termed a royalty, be introduced in the salmon fishery beginning at a low level of 2%. As Dr. Sinclair points out, a royalty or landings tax does not lead to the distortion of capital and the equity problems discussed above for a license fee system.

A taxation system in theory can be used to move the fishery to its economically optimal level of production. To do so, however, the tax would have to be differentiated according to time, species and area. It is not known what degree of differentiation in the tax structure for salmon would be feasible at a reasonable cost but there is clearly some point where the benefits would be less than the additional costs of imposing them. It may be, however, that as the fishing fleet became increasingly rationalized under a taxation scheme, the possibility for additional specifications would also increase. By raising the marginal fishing costs to a level reflecting the value of the resource to society, a tax would reduce effort in the fishery and pressure on the stocks.

There are several theoretical and practical reservations to using taxes to rationalize the fishery. Some of the most important are the following:

(1) To set the tax at a level that approaches the economic optimum assumes a level of knowledge of costs, stocks and prices that is

unavailable. This would not seem to be an insurmountable problem as the tax could be adjusted over time as more information (for example, license values) became available. In practice, however, things would not be so easy in the salmon fishery. The year to year variability in the fishery and the inability of biologists to make precise predictions about stock levels, implies that the tax would have to be changed frequently. On-line changes in tax levels would imply the existence of one man or one body that had the discretionary authority to do this. The volatility of the salmon fishery raises serious doubts about the ability of administrators to gather and analyze information fast enough to respond to rapidly changing conditions.

(2) Even if taxes could be altered at short notice, their impact on the effort directed at the stock is unclear. Participatory behaviour of fishermen is not sufficiently understood to allow managers to predict their response to increased taxes. A fluctuating level of taxes could also complicate the decision process of fishermen to such an extent to make planning difficult.

(3) Before the impact of a certain tax level could be ascertained it would be necessary to determine the incidence of such a tax. The tax burden will be shared by fishermen, fish buyers, sellers at the wholesale and retail levels and consumers to a varying degree depending on market structure and value added. This may well mean the impact of the tax will be felt more by some fishermen than others. For example, trollers who are not unionized and sell in the relatively competitive fresh/frozen market will be affected differently by tax than unionized seiners selling to obligopsonistic processors.

This diverse impact of the tax on different fishermen may not be desirable and could lead to distortions of fishermen's behaviour as they attempt to minimize the tax burden borne by them.

(4) A tax system will reduce effort in the fishery by increasing the costs of fishing to fishermen. In a fishery where costs are already high and where many fishermen are at the margin[45] it seems inevitable that a good part of this effort reduction will occur by the involuntary withdrawal of vessels from the industry rather than the reduction of landings or other forms of adjustment. The social desirability and political acceptability of such an outcome is dubious. Dr. Sinclair downplays the adverse effect of a tax on fishermen's earnings by saying; "... if the tax is introduced at a relatively low rate at first and gradually increased the effect will be imperceptible, and it may be shifted to the consumer." This statement ignores the fact that to make a substantial move towards a more efficient industry the tax has to be high enough to substantially reduce effort. Both capital and labour will be forced out of the fishery, likely in significant amounts. Without compensation, a tax scheme would impose an unacceptable burden on fishermen. A low tax rate or a tax that is shifted to consumers simply implies that overinvestment in capital will continue. A particular distributional problem is that the three gear types will be affected by a tax according to their relative efficiencies. Presently, each type is allocated a share of the catch (through

area and time closure regulations that vary by gear type) to ensure that the more inefficient gear types remain viable. It is assumed that a tax system would also imply a phasing out of such efficiency reducing regulations. If so, an inefficient gear type would experience great hardship. Thus certain areas and well defined groups of fishermen would be seen to bear the brunt of a taxation scheme.

A tax on the value of landings is a useful tool to extract rent from the fishery. It can also, if set high enough, curtail effort by increasing the marginal cost of fishing. Despite its usefulness, however, it is doubtful that either it or a license fee would be an adequate tool in a program designed to make a serious attempt to optimize returns in the fishery. A high enough tax would reduce pressure on the stock but it is clear that taxes and license fee systems are not precise stock management devices. On-line time area and time closures would still be crucial to ensuring adequate escapement of the various stocks.

At least some portion of the rent extracted through taxation would have to be returned to the fishermen. Some version of the buy-back scheme could be used to compensate fishermen forced out of the industry.[47] It is more difficult to come up with with a scheme to allocate some of the rent to remaining fishermen. What is clear, however, is that the revenue generated from a significant tax would have to be returned, in part at least, to fishermen. This view is in agreement with the stated goals of most fisheries management programs - to increase the income of fishermen.

Property Rights

The final alternative management structure considered here is a property rights scheme with oversight by a quota management agency. There are two forms a property rights scheme could take. One would involve the allocation of geographic rights to individuals or companies. The geographic area specified under such a scheme would have to be large enough to impart complete control over a stock of fish. The second would be to allocate to individuals or companies rights to a specified quantity of fish.

The first scheme is not practical in a fishery such as the salmon fishery where the fish stock is mobile over a wide geographic area. It would imply conferring sole ownership to an individual or company over a large part of the Pacific Coast. In an industry with a large number of independent fishermen such a scheme must be viewed as socially inequitable and politically infeasible. The second approach offers more promise.

A system of property rights, appropriately specified and enforced can lead to economically efficient fishing.[48] The common property problem is addressed directly by imparting proprietory rights to the use of the stock to individuals. An individual, with his total production specified by the quantity of rights held, has an incentive to minimize the cost of achieving this level or production. For maximum efficiency the total harvest level should be based on economic criteria but, with some efficiency loss, it would be set on a biological basis to lower the information requirements for determining the total allowable catch.

It should be noted that property rights, like taxes, would have to be area, time and species specific for optimal efficiency. In practice, such a detailed specification of property rights is probably not the best approach due to high administrative and enforcement costs. A more feasible approach would be to allocate quotas to fishermen with less detailed specifications. In areas, times and for species where potential catching costs are low (i.e. salmon are densely schooled), fishermen would still have an incentive to compete for a larger share of this catch. Such an incentive would lead to investment behaviour resulting in costs higher than the base minimum necessary to achieve the catch. It is felt, however, that such additional costs would be less than administration and enforcement costs of a more specific rights system and minor in relation to pre-emption costs incurred where quotas are not in place.

A quota system requires several specifications necessary for efficient operation:

1. The quotas must be freely transferable[49] The market can subsequently be relied on to allocate quotas to least cost harvestors. Given perfectly functioning capital markets, only the most efficient fishermen can afford to pay the price for a quota on the open market.
2. Quotas must be sufficiently divisible to be within the production scale of smaller producers. Divisibility also allows small producers to compete more equally in capital markets with larger operators or fish buying companies.
3. The variability, unpredictability and short season length for salmon, dictate that any management plan in the fishery be flexible enough to make quick and sometimes substantial alterations in the total quantity of quotas available in the fishery. This implies the existence of an agency which can enter the quota market quickly and buy and sell rights. There is some concern about the feasibility of this in the salmon fishery. This had led Moloney and Pearse to conclude: ".... there are almost certainly cases where adjustments

through the market for rights would be too slow, and fishing activity must be regulated by fiat." [50] The government must, therefore, maintain the ability to practice on-line management through discretionary area and time closures. [51] First, decreased pressure on the resource resulting from the quota scheme would reduce the need for area and time closure regulations to protect the stock. Second, the quota marketing agency could hold some rights in reserve providing a safeguard against prediction error. Once it becomes obvious what level of fishing will allow adequate escapement, those resource quotas could be auctioned off or otherwise distributed. Such a scheme would minimize the need for area and time regulations.

4. The tenure of quotas issued must be specified. Quotas could be given in perpetuity or could be allocated for a period as short as one year. Perpetual quotas would have the advantage of being easier and less costly to administer while creating a more certain environment for the fishermen to plan future decisions. Year-long quotas imply that the value of the quota would be lower and the impact of poorly functioning capital markets on smaller producers would be decreased as a result of lower entry costs. In addition, they may offer some distributional

advantages over a perpetual quota which would provide a once-and-for all windfall to the original holders of quotas.[52] The rent could be spread out between original and future holders of quotas. In practice, an intermediate scheme which allocated quotas for some specified number of years may be the answer.

5. If quotas are not specified by time, area and species, it is likely that stocks in a certain area or of a certain species may be severely depleted or extinguished.[53] This is due to the incentive for fishermen to exploit stocks with low catching costs as described above. If this problem cannot be alleviated by appropriate specifications on the quotas, supplemental area and time closure regulations may be needed.
6. The government may want to appropriate some revenue from the fishery to cover the cost of the new management scheme. This objective is already embodied in the Salmonid Enhancement Program although it has not been acted on to date. Of course, with effort and pressure on the stocks reduced, there will be savings as present regulations to ensure escapement are relaxed. As mentioned in point 3., the government could auction off at least part of the quotas using the derived revenue to cover costs.
7. The fishermen, presently in the fishery, should also be direct beneficiaries of the program. This is in line with the objective of most management programs to increase the net incomes of fishermen and is undoubtedly necessary for political acceptance of the program. Note that the initial distribution of rights can be tailored to fulfill whatever distributional objectives managers desire in the program. For example, quota levels could be based on the historic landings of licensed participants in the fishery. It may be necessary to initially

establish quotas at a level below those recorded in previous years to permit stock recovery. While fishermen could be expected to benefit from the increased stocks in the long run, they may experience financial losses in the short term. A compensation scheme would then be required to prevent the involuntary withdrawal of vessels.

An appealing method to distribute quotas would be to allocate them to license holders based on past production. Under such a system vessel owners would have the option of remaining in the fishery or selling the quota and withdrawing from the fishery. Crew members would be in a more perilous position. As fleet numbers declined, many would be forced out of the fishery with no compensation. That is, they would have no share in the so-called voluntary sale. In the salmon fishery, with its strong union, such a possibility would occasion a great deal of dissent. An alternative method of distribution or a compensation scheme may be necessary.

It appears that a property rights scheme has several significant advantages over a taxation scheme. Perhaps the most important is that it allows the market to solve the cost minimization problem while a taxation scheme would require an immense amount of information and sophisticated biological and economic modelling to arrive at the same solution. In fact, some analysts feel that, with a salmon quota scheme, the total quota (or total allowable catch) could simply be set on biological grounds requiring no economic information.[54] Such separability would facilitate management and reduce costs.

A quota scheme is a more precise stock management device as fisheries' managers can specify the total catch in any season. In addition, it appears that the quota scheme would adapt more readily to the volatile changes to be expected in the salmon fishery. Realistically, taxes provide only a mechanism to adjust the long-term effort directed at the stock. Accordingly, under a quota scheme, it could be expected that less supplemental regulations (closures) would be required to ensure adequate spawning escapement. Finally, quotas could be more easily adjusted to take advantage of unusually large runs of fish. Biologists claim that the average yield can be significantly increased if the catch is adjusted to take advantage of natural fluctuations. Distributional objectives can be ahcieved under either system. With a quota system however, the appropriate distribution can be achieved simply through the initial allocation of rights whereas special provisions and programs would be required under a taxation scheme.

Before conclusions can be drawn as to which management scheme would be most desirable, the relative costs of both programs bear examination. In this analysis, only management costs will be considered.[55] It must be stated at the outset that no projected administrative and enforcement costs are available for either scheme. The best that can be done is to make some qualitative statements concerning the expected relative costs of both programs.

The first point to remember is that part of the costs of both programs can be written off from savings from decreased costs of administering and enforcing current area and time closure regulations. These regulations can be relaxed somewhat under both schemes, but more so with the quota system. Secondly, both programs are conducive to allowing the government to recoup administrative costs so that no additional burden is necessarily imposed on Canadian taxpayers.

Since there are no estimates of projected administrative costs, it cannot be stated with certainty that either program would yield higher aggregate net benefits. The apparent high economic rent potential of the fishery, however, indicates that this fishery, of all fisheries, holds out the promise of significant net benefits to society from effective regulation. It can be said with some certainty that either system will incur costs in excess of potential benefits, if applied in a manner thatattempted to arrive at close to optimal industrial performance. Any evaluation of the alternatives must include the following points:

1. Enforcement Costs - As was discussed above, any management plan must be designed to achieve the best use of the resource over the whole fishery, not just the commercial sector. It must be able to facilitate the re-allocation of the resource between the two sectors based on the economic and social objectives established for the plan. In theory, at least, a property rights scheme applied to both sectors would achieve this aim at least cost to the government. While such a scheme may give rise to service administrative and political problems, the superiority of the property rights scheme from an efficiency point of view demands that it be considered seriously.

2. Political Acceptability - Both schemes are basically untried and could be expected to induce considerable opposition in the industry. Although quota schemes often evoke negative reactions among fishermen, this could be due to an inadequate understanding of the implications to fishermen of this scheme. Careful educational and consultative work would be essential before quotas can be expected to achieve a wide consensus among fishermen. From the above analysis, however, it is evident that fishermen can be expected to be the major beneficiaries of this program.

Taxes are more problematic. Taxes directly impinge on the earning capacity of fishermen and if imposed at a high rate would be a direct threat to their survival in the fishery. Special programs to recycle tax revenues to fishermen, in a way that would not affect investment behaviour, would have to be designed and sold to the fishermen. It has been suggested that a phased in tax system that gradually increased the tax rate could be politically acceptable. To be effective, however, a tax has to decrease fishermen's earnings until fleet capacity is reduced to the desirable level. The inevitable result is that many vessels will be forced out of the fishery due to an inability to cover fishing costs.

3. An Intermediate Program - The evaluation and recommendations in this report assume that it is possible and desirable to manage the fishery in a way that maximizes economic efficiency. Such a drastic departure from present management practices and the status quo in the fishery may, however, not be deemed feasible or advisable at this time. A compromise solution may be sought. One possibility is a moderate, relatively stable tax combined with a buy-back program. The tax would capture some rent from the industry and impose some constraint on effort. It would also provide revenue for the buy-back scheme and moderate the rise in license values, ensuring the survival of the program. As more vessels were retired through the buy-back program, rising license values could signal the need for gradual tax increases. While this would represent an improvement over the current situation, it would only go part way toward attaining the full economic potential of the industry.

FOOTNOTES

1 This overview of managerial developments in the salmon fishery is not comprehensive. For a more detailed description of events in the salmon fishery up to 1969, see:

1 B. A. Campbell, License Limitation in the British Columbia Fishery, Report, No. 1, January 1974.
2 G. Alex Fraser, License Limitation in the British Columbia Fishery, Tech. Report Series No. PAC/T-77-13, Economic and Special Industry Services Directorate, pp. 1-21.
3 Cicely Lyons, Salmon - Our Heritage, 1969.
4 S. Sinclair, License Limitation - British Columbia, Ottawa, 1960, pp.13-38

2 B. A. Campbell, A Review of Salmon License Control Programs and Proposals for Limitation in B. C. - 1880-1967, Report No, 1, January, 1974.

3 Cicely Lyons, Salmon - Our Heritage, 1969, p. 370.

4 Ibid, p. 392

5 see Table 1.1

6 Dr. S. Sinclair, Op.cit., 1960, p.26.

7 H. Scott Gordon, The Economic Theory of a Common Property Resource: The Fishery , Journal of Political Economy, 1954

8 Dr. S. Sinclair, Op.cit., p.3.

9 For a more thorough discussion of license limitation and associated programs, see:
B. A. Campbell, License Limitation in the British Columbia Fishery, Report No. II, January 1974.
S. Sinclair, A Licensing and Fee System for the Coastal Fisheries of British Columbia, Vol. I, 1978

10 Special provisions were made for Indian fishermen in the Davis Plan. These are detailed in the section of this report entitled The Native Indian Fishery and not included here.

11 Note that this criteria was subsequently changed so that production in fisheries other than the salmon fishery could qualify a vessel to obtain an "A" or "B" license. This was an obvious problem in the program as a number (about 160) of large trawlers and longliners acquired salmon licenses and could retire these non-salmon vessels and replace it with a salmon vessel.

12 For a thorough analysis of the "buy-back: program, see B. A. Campbell, Op.cit., Report No. II, 1974.

13 License fees remained stationary at their 1971 level.

14 For details, see S. Sinclair, Op.cit., 1978, p. 38.

15 For an overview of the program, see the 1977 report of the Fisheries and Environment Canada entitled The Salmonid Enhancement Program.

16 _Ibid._, p. 60

17 _Ibid._, p. 59

18 The evaluation conducted here is for the commercial fishery only. For an analysis of the management program in the sports fishery, see the section on the Sports Fishery in the Appendix of this report.

19 Rent is defined here as the total revenue from the resource minus the total costs of harvesting and processing the resource.

20 For a more detailed explanation see the _General Analysis_.

21 B. A. Campbell, _Op.cit._, Report No. II, 1974.

22 G. Alex Fraser, _Limited Entry: Experience of the British Columbia Salmon Fishery_, JRFBC, Vol. 36, No. 7, July 1979, p. 754-63.

23 The rise in the real value of the resource has implied an increasing amount of investment in harvesting capacity.

24 P. H. Pearse and J. E. Wilen, _Impact of Canada's Pacific Salmon Fleet Control Program_, JRFBC, Vol. 36, No. 7, July 1979, p. 764-69.

25 As can be seen in Table IIa-1 of Appendix IIa, the increasing catch of pink salmon by troll vessels is responsible for the rise in the relative share of their catch in total landings.

26 For example, the weekly time closures for the net fishery do not apply in the troll fishery. While the design of closure regulations favours gillnet vessels over seine vessels, it is claimed that the implementation of these regulations is biased against terminal (near shore) gillnetters. That is, discretionary closures to ensure adequate escapement are made more frequently in the terminal gillnet fishery as information on individual stock sizes is more readily available at this point.

27 B. A. Campbell, _Op.cit._, Report No. II, January 1974.
G. Alex Fraser, _Op.cit._, Report Series No. PAC/T-77-13, 1977.
S. Sinclair, _Op.cit._, Volume I, 1978

28 S. Sinclair, _Op.cit._, p.44-45.

29 _Ibid._, p. 40-41.

30 Note that the prevailing closure regulations in the fishery are designed to allocate each gear type a given allocation of the catch. This makes the determination of the relative efficiencies of the three gear types difficult, if not impossible.

31 G. Alex Fraser, _Op.cit._, July 1979, p. 759.

32 see Table _____ of Appendix ___.

33 Caution must be exercised in attributing all of this investment to events in the salmon fishery. Almost 75% of rise in real capital employed occurred in the combination seine category most of which was used to gear seiners up to catch herring.

34 P. H. Pearse and J. E. Wilen, Op.cit., Vol 36, July 1979, p. 768.

35 Ibid, p. 768.

36 Ibid., p. 768.

37 S. Sinclair, Op.cit., p. 40.

38 In 1976, for example, about $1 million in revenue was derived from license fees while about $20 million was incurred in management costs.

39 See the section on the Native Indian Fishery.

40 For more details, see B. A. Campbell, Op.cit., January 1974.

41 Fisheries and Environment Canada, The Salmonid Enhancement Program, September 1977.

42 Both of these proposals are anticipated to be in place by 1981, however.

43 For a variation of this approach see V. W. Loose, Optimal Exploitation of a Salmon Fishery: A Simulation Approach, Unpublished Ph.D. thesis, UBC, 1977.

44 The license fee system in the salmon fishery is really a tax on one in-put-tonnage. For an analysis of the distortion effects of input taxes see A. D. Scott, Development of Economic Theory on Fisheries Regulation, Vol. 36, No. 7, July 1979, pp. 725-741.

45 The section on the primary sector illustrates that there is a great deal of variability in the profitability of vessels within each gear class.

46 S. Sinclair, A Licensing and Fee System for the Coastal Fisheries of British Columbia, Vol. I., p. 253.

47 Since, with a tax, the capitalized value of rent in the license would be low, the government would have to devise a new method of determining the payment to a fisherman for retiring the license. See the lobster case study for one possible method to establish such a payment.

48 See D. G. Moloney and P.H. Pearse, Quantitative Rights as an Instrument for Regulating Commercial Fisheries, JFRBC, Vol. 36, 1977, and the General Analysis of this report.

49 Society's preference for an independently owned fleet may necessitate some constraints on transferability to constrain acquisition of a large number of quotas by companies.

50 D. G. Moloney and P.H. Pearse, Op.cit., July 1979, pp. 859-866.

51 It should be noted, however, that any power of closure left to the management body will alter the incentives to the individual fisherman. If the fisherman perceives that the managers may close the fishery, there will be an incentive for the fisherman to attempt to get his quota while the fishery is still open. This incentive could be avoided to some extent by undertaking to compensate those with unfulfilled quotas by the time of closure. Compensation could be paid at the current market price for quotas.

52 Perpetual quotas could be taxed, however, without any alteration in the investment incentives of the fishermen.

53 Note that there is room for some specifications of the quotas. They could specify the time of fishing forinstance to prevent excessive effort for short time periods.

54 The biological and economic maximum stock level is generally thought to be higher than the biological maximum, the difference may be small due to the social rate of time preference. For a discussion of this see the General Analysis section.

55 For a more complete discussion, see P. H. Pearse, Property Rights and the Regulation of Commercial Fisheries, Resources Paper No. 42, UBC, August 1979.

APPENDIX I

The Resource

Salmon is a highly priced, commercially valuable fish. Not only is it valued for its taste, texture and colour but it is also an appealing sports fish. There are five species of salmon - chinook (spring), sockeye, coho, chum and pink which are all commercially exploited. Differences in taste, flesh colour, oil content and outward appearance determine the attractiveness of each species to the various commercial and recreational end uses. The following chart details some characteristics of each species.

	Average Weight (lbs)	Flesh Colour	Life Cycle (yrs)	Primary Gear Used*	Approx. time of availability in the fishery
Sockeye	6	Red	4-6	Net	June-October
Coho	6½	Red	3-4	Troll	June-November (mainly in August)
Chinook	12-20	White Pink Red	3-7	Troll	March-October
Chum	11	Pale Pink	3-5	Net	July-November
Pink	4	Pink	2	Net	July 15- September 30

*Gear used represents only the primary type of gear used to catch each species. Coho and chinook salmon are also the mainstay of the recreational fishery.

All five species of salmon are anadromous fish returning to fresh water to spawn after a period in the open area. The Chinook, Coho, Pink and Chum all spawn in running streams while the Sockeye generally spawn in lakes in tributaries of lakes. The amount of time a young salmon spends in fresh water before migrating to the ocean varies by species (and even within the species). Pink and Chum salmon migrate early in the first year while Sockeye generally spend at least the first year of their life in fresh water. All Pacific salmon reaching the salt water remain there until reaching maturity at ages indicated in the life cycle column of the above chart. The time of year during which salmon run to their spawning grounds varies widely between and within species and can occur any time between early spring (for the Chinook) to as late as November (for the Sockeye).

Sockeye, pink and chum salmon are basically plankton feeders and stop feeding at maturity as they approach fresh waters en route to the spawning grounds. As a result they are more suceptible to being caught with net gear. Chinook and coho, on the other hand, do not stop feeding as they approach fresh water and feed on smaller fish. This, combined with the fact that they are not densely schooled in open water makes them more conducive to being caught by hook-and-line gear.

Salmon become subject to the commercial fishery on their return migratory route. Since salmon are not densely schooled in the open sea capture at this time is more costly than if they are caught on their homeward migratory route. Some salmon emanating from Canadian streams spend part of their life cycle in American waters and are subject to mortality from American fishing on their migratory route. Consequently, management of this resource, particularly those salmon coming from the Fraser River system, requires coordinated efforts on the part of the United States and Canada. The Fraser and Skeena Rivers are the major producing rivers, accounting for over 50 percent of the salmon caught in British Columbia.

Since salmon form schools and run up the river to their spawning grounds they can potentially be harvested cheaply in or at the mouths of the rivers. The tendency of Chum, Pink and Sockeye salmon to school in the ocean makes them most accessible to seiners and gillnetters. Salmon do not generally feed in fresh water, however, and the quality of the fish deteriorates markedly as they progress up the river toward their spawning grounds. The anadromous nature of salmon has several important implications for the salmon fishery:

1) While salmon can be caught easily and cheaply they are also extremely vulnerable to overfishing and possible extinction.

2) Because salmon spawn in fresh water and spend their early life in rivers and lakes, they are affected by economic activity outside the fishing industry. Blockages and industrial effluent in spawning streams have, in the past, had disastrous consequences for certain salmon runs. By the same token, however, fresh water spawning raises the possibility of enhancement of the stock.

3) The size of the spawning area is relatively small for salmon and subject to overcrowding. A large spawning stock implies a high mortality rate for the fertilized eggs which places an upper bound on the desired escapement of salmon for spawning.

4) Salmon from the various rivers form distinct biological units each exhibiting differences in habits, methods of growth and periods of maturity. In addition, different species often run up the same river at the same time of year making species discriminiation in the fishing difficult. These characteristics render the task of enforcing optimal escapement for each stock impossible.

5) Anadromous fishes are unique in that it is possible to get direct or near-direct estimates of the breeding population.

Due to the migratory habits of salmon, fishing is a seasonal occupation for both the harvesting and processing sectors of the industry. The timing of the runs varies from year to year while regulations further accentuate the stop-go harvesting of fish. In addition, there is a high level of variability in the runs of each species stemming from their dependence on fresh water environments for spawning, fluctuations in ocean survival rates and due to the fact that only one or two year classes are subject to capture. Annual fluctuations are more extreme in the case of Pink, Sockeye and Chum, than for Coho and Chinook because the latter two species are more widely distributed in their spawning environment. The seasonal and cyclical variability of salmon available for harvest induce a greater degree of capitalization in harvesting and processing facilities than would be required for a more stable fish population. The complexity and variability of the spawning - recruitment - mature stock relationship also makes it difficult to ascertain the pay-off from any investment in enhancement. While enhancement may be able to increase the number of fish available for capture it may be more difficult to achieve a smoothing out of the cyclical variability of the stock.

Salmon are only available for capture for short periods after which they die. This fact combined with the variability described above implies that a flexible management policy is desirable. the use of time and area closures in the fishery have been employed to allow fisheries managers to assure a desired level of escapement from a variable stock. The seasonal nature of the fishery also implies that many salmon fishermen and vessel can continue to engage in another fishery.

Appendix II - Market Structure

a) The Primary Sector

Overview

Salmon are fished by three major gear types - seiners, gillnetters and trollers. This section provides a description of the primary section composed of these gear types. There are a large number of vessels participating in the fishery and no one vessel accounts for a sufficiently large percentage of landings to influence price. Thus the harvesting sector has been classified as competitive.

The primary sector is not purely competitive, however, for several reasons. Many fishermen, particularly net fishermen, are represented by organizations, the largest of which is the United Food and Allied Workers Union. This union represents and bargains for all crew members on seine vessels, a high proportion of independent gillnetters and a small number of troll fishermen. Note that it also represents and bargains for workers in processing plants. The union engages in bargaining with the Fisheries Association over minimum prices for each species establishing a floor price for salmon. Market prices for each species have been above the established minimums in the last number of years implying that there has been little restriction on competitiveness of the industry due to minimum price agreements. However, the minimums may be more relevant in various areas at certain times of year and could protect fishermen from unanticipated declines in demand. Other major fishermen's organization in the fishery are the Native Brotherhood of British Columbia, the Pacific Trollers' Association and the Pacific Gillnetters' Association. In addition a substantial number of fishermen are members of cooperatives which accounted for about 12.1% of total landings in 1977.

Another factor that reduces the independence of the fleet is company ownership and control of vessels. Up until 1969 companies had no restrictions on the number of vessels they could own. At that time they owned 776 licensed fishing vessels representing 11% of the total fishing fleet. With the implementation of the license limitation program they agreed to reduce fleet numbers at the same rate as the decline in the total fleet. As of 1977 they owned about 9% of the total fleet and 12% of the total A fleet.

Company ownership of vessels varies greatly by gear type. For example, Table II-a.25 shows that in 1977 about 24% of seiners, 15% of gillnetters and only .4% of trollers were company owned. In addition, to direct ownership companies have other indirect involvement in the fleet. Such involvement has taken the form of the provision of financial services, supplying net loft and gear storage facilities and operating a packer fleet. Table II-a.27 shows the debt situation of licensed vessels in general and with processing companies in particular. These figures indicate that while the total percentage of vessels in debt has remained constant, those in debt to processors has declined significantly. In addition, while in 1970, 36% of total fleet debt was held by companies the percentage declined to only 7% in 1977. Clearly, this implies a greater independence of the fleet from the processing companies.

The following sections describe the structure and performance of the salmon fleet from 1967 to 1977. Note that the most important difference in the fleet is that the net fisheries primarily fish for the canned salmon market while the troll fishery supplies the fresh/frozen market.

Salmon Seiners, 1967-1977

There are two classes into which salmon seine boats are divided -- single gear vessels and combination vessels. A single gear salmon seine vessel fishes for salmon only, while a combination vessel may use either gillnets or troll gear in addition to the seine gear to fish for herring, longline for halibut and trawl for bottom fish.

Salmon seiners accounted for between 30% and 40% of total salmon landings in the 1967-1977 period.[1] The proportion of landings accounted for by seiners varied widely for the different species of salmon. The proportion was greatest for pink salmon (varying between 50% and 75%) while a large portion of the chum salmon (40% to 50%) were also accounted for by this gear type. While gillnetters landed the majority of sockeye salmon, seiners accounted for a significant percentage of total landings (from 25% to 35%). The importance of seine gear was not as great for coho (12% to 20%) or chinook (7% to 12%). Over the 1968-1977 period, seiners have surpassed gillnetters as the dominant gear type in terms of total quantity landed, as illustrated in Table IV-1. Despite the dominance of seine landings in total landings, especially in the later years, their contribution to total gross income from the salmon fishery has been consistently below both of the other gear types.[2]

The reasons for this are twofold. The main reason is that salmon seiners primarily catch the species of salmon which command the lowest prices. Remembering that the primary species caught by seiners are pink and chum, this is illustrated in Table IV-3. An auxiliary explanation, illustrated in Table IV-4 is that salmon seiners receive a lower price for any given species than gillnetters or trollers. While quality considerations account for a major portion of the difference, the relatively high degree of buyer concentration for seine caught salmon has also been reputed to be of importance.[3]

For a closer examination of the salmon seine fleet, the two components of the fleet, single gear and combination seiners, will be examined separately. This approach is justified by the fact that events inside and outside the salmon fishery since 1967 have had a markedly different impact on each component. For example, since 1973 the number of combination seiners has exceeded the number of single-gear seiners whereas five years before this time there were twice as many single gear than combination vessels.

Single-Gear Seiners

Reviewing the data for 1977 one cannot detect a significant change in this fleet from 1967.[4] In 1977 the average vessel was 53.2 feet long, had a capacity of 21.2 net tons, was 36.4 years old, fished 35.9 days and was powered by a 177 horsepower motor. By comparison, in 1967 the average vessel was 50.5 feet long, had a capacity of 22.8 net tons, was 31.8 years old, fished 36.0 days and was powered by a 142 horsepower motor. There were fewer single gear seiners in 1977 than 1967, with 232 in 1967 and 221 in 1977. The number in this fleet have declined steadily since 1970 when there were 293 boats operating. These figures tend to indicate that the amount of effort from this component of the fleet has remained stationary or declined. It is probable, however, that there was a substantial increase in the use of electronic equipment by these seiners over these years[5] which, combined with other capital innovations, has increased the fishing power of a vessel. Estimates of real capital employed per vessel,[6] however, reinforce the belief that effort in this component has probably declined.

Total gross fishing income from single gear seiners is divided among three interest groups: the boat and net owner, the captain or operator, and paid crew members. Payment is made to each interest group based on a share system that has prevailed since the 1940s. Under this system, the initial payment is divided (after deducting fuel expenses) as follows: 4/11 for the net and boat owner and 7/11 for the crew, including the captain. In addition, the captain receives a captain's bonus and the boat and net owner receives a year-end charter.[7] Operating expenses are then charged against each interest group with the operator and crew only being charged food costs.

It has been estimated that in 1976 the average return to the boat and net owner on capital investment was 9%.[8] Returns vary widely within the fleet, however. The table shows that the return varies from 0% for vessels with a low level of capital investment to 25% for capital intensive vessels. Likewise, weekly returns to crew members vary from $250 to $650 for these groups. Although seiners with the lowest capital investment made no return on investment in 1976, if there was no outstanding debt on the boat they would receive an annual cash income of about $9,000. This would permit continued participation of these boats in the fishery in the short run.

Although high income seiners were somewhat larger and more powerful than low income vessels, there was a major difference between the two categories in weeks fished and the number of deliveries.[9] Vessels earning less than $40,000 per year averaged about 25 deliveries for 11 weeks fished while those earning more than $80,000 per year averaged 40 deliveries for about 18 weeks fished. The seiners that earned over $80,000 per year were considerably smaller than some lower income earning vessels but had an average age of under 15 years and seemed likely to have had more sophisticated equipment than the older vessels. Such an investment resulted in returns on capital of over twice that of the next income category of vessel.

Combination Seine Vessels

The number of combination seine vessels rose sharply from 181 in 1967 to 293 in 1977.[10] Within this period there were two distinct trends; between 1967 and 1969 the number of vessels plummetted from 181 to 84 while from 1969 to 1977 there has been a consistent increase. As can be seen by the table combination seiners are larger, more powerful and fish longer than single gear seiners. The figures make it clear that effort from this component of the seine fleet has risen dramatically since the late 1960s and early 1970s. Figures on real capital employed per vessel indicate a jump of between 49% and 63% between the period 1969 and 1977.

The key feature which distinguishes combination vessels from single gear seiners is their ability to engage in fishing salmon by using other gears and to participate in fisheries other than salmon, notably halibut and herring. In fact, in 1977 less than half (45.7%) of the gross income earned by combination seiners came from the salmon fishery.[11] Combination seiners can supplement their income from seining for salmon by fishing other gears in the salmon fishery and by participating in other fisheries. Until 1972 longlining for halibut was the major supplement, accounting for 42.8% of combination seiner gross income in 1970, while seining for herring has assumed this role since that time, accounting for 41.6% of combination seiner gross income in 1977. Fishing salmon by gillnets and trolls has never contributed substantially to the gross income of combination seiners although it has accounted for up to 20% of the total days fished of these vessels.

Due to the importance of the herring fishery to salmon seining since 1973, an analysis of the performance of the fleet in these two fisheries is presented.[12] In 1976, the estimated additional investment for a salmon seiner to enter the herring roe fishery was $65,000. Seiners participating in the herring roe fishery employed slightly larger crews than they did in their salmon operations. (5.9 in herring compared to 5.3 in salmon) but fished under four weeks for herring compared to about 15 weeks in salmon.[13]

The crew share of the income derived from the herring roe fishery is negotiated prior to each season. The operator and crew receive equal shares but the operator receives a bonus of an extra gross crew share. The herring boat and net share is calculated as the gross crew share minus the captain's bonus.

Based on the assumption that an extra $65,000 was invested in 1976 to participate in the herring roe fishery, combination seiners received a rate of return of 14% on this capital investment. Combination seiners also received a higher rate of return of 11% in the salmon fishery compared to single gear vessels which received a 9% return on capital invested.[14] In addition, crew members received much higher weekly wages than those on single gear boats, being paid $475/week and $1525/week in the salmon and herring fisheries respectively. These boats spent less time in the salmon fishery on average than did single-gear vessels.

The greater profitability of the herring roe fishing provides an explanation of the large increase in combination vessels since 1969 and especially since 1973. It is more difficult to determine if this has led to increase in the capacity of the seine fleet as a whole in the salmon fishery but this appears likely.

Gillnetters

Until recent years gillnetters accounted for the largest volume of salmon landings. In 1977, they were second in volume to seiners and, along with trollers, accounted for greatest percentage of gross income from salmon fishing. Historically gillnetters have accounted for the vast majority of sockeye salmon although their share had decreased to 62% by 1977. Other important species for gillnetters are chum (53.4% in 1977) and pink (22.1% in 1977) salmon with chinook and coho being less important. (See Table IV-1).

There are more gillnett vessels in the salmon fleet than seiners and trollers combined, although their numbers have declined substantially since 1967. As with seiners, gillnetters can be grouped into the classifications -- single gear and combination gear and will be analyzed according to these classifications.

Single Gear Gillnetters

This vessel type is the most numerous in the fishery. It has also experienced the greatest decline in numbers, falling from 2,041 in 1967 to 1,524 in 1977.[15] Contrary to the trends in combination gear types, single gear gillnetters had an increase in numbers from 2,041 in 1967 to 2,462 in 1969, but consequently experienced a large, consistent decline to the 1977 level of 1,524. Average characteristics of these vessels are shown in Table IV-15. As is shown the major change has been the addition of over 60% in the horsepower of these boats. Estimates of real capital employed per vessel[16] show an increase of from 10% to 27% over the period 1969 to 1977. As was the case with the single seine vessels, it is probably safe to conclude that the fishing power of this vessel category has declined over the 1967-1977 period.

The average single gear gillnet vessel is a one-man operation although some vessels do hire additional labour. Most gillnett vessels (about 80%) are privately owned and, therefore, most vessels fall in the owner-operator category. As with seiners the profitability of vessels varies widely within the fleet. Table IV-16 derived from a study by G.S. Gislason, illustrates that using an opportunity cost of labour of $260/week, the return on investment for all gillnetters was under 7% but ranged from -2.9% to 31.3% from vessels with varying levels of capital invested.

The major differences between low and high income gillnetters seems to be in the amount of capital invested, the number of weeks fished and the number of deliveries made. For example, gillnetters in the less than $5,000 income class fished for an average of 5.9 weeks making 11.8 deliveries while those in the $20,000 and over income class fished for an average of 16.1 weeks and made 50.8 deliveries.

Combination Gill Net Vessels

In addition to fishing Salmon by means of gillnets, combination vessels fish salmon by trolling, food herring by gillnet, halibut by long-lining and bottom fish by trawl. The number of boats in this category [17] varied widely until 1974 but has shown a consistent increase since that time. Numbers plummetted in 1969 to 961 -- about one-half the number in 1967. Combination gillnetters are slightly larger than single gear vessels although they have the same horsepower. The major difference is in the number of days fished which is between 55 and 60 for combination vessels but only between 30 to 35 for single gear vessels.[18] Days spent fishing salmon are less for combination vessels than for single gear vessels while they make up the remaining time mainly trolling for salmon.

From the data in Table IV-19 it appears that gillnetters are much less diversified than seiners outside the salmon fishery. This impression is misleading, however, as roe herring gillnet operations are conducted from punts with a regular gillnet or troll vessel used as a supporting vessel. Landings are reported against the punt and not the supporting vessel and so do not appear in the data for either gill-netters or trollers. There were 1,329 licensed herring roe gillnet punts in 1977 accounting for 41.5% of total landings.

A study by Gislason for 1976 makes it possible to present an economic profile of gillnet-troll combination vessels. The average income of these vessels is more than 50% higher than that of the average single-operation vessel with approximately two-thirds of the income derived from salmon gillnet operations.[19] Tentative results show that the average rate of return for combination vessels is 9.8% compared to a 6.8% average for single operation gillnet vessels.[20] The dispersion of rates of return by level of capital invested are seen to be substantial but more moderate than for single operation vessels. The relatively high average rate of return could explain the increase in the number of combination vessels. These results are tentative for reasons explained in Gislason[21] and because herring roe income is not considered.

Combination Gillnet-troller vessels were somewhat larger than single operation vessels but the crucial difference appears to be that they had a higher level of capital investment, fished longer (18 weeks compared to 12.6) and had a much larger number of deliveries (53.2 compared to 31.3). Combination vessels, however, spent less time fishing will gillnets than did single operation vessels.

Within the combination gillnet-troller category, data indicates that vessels with a high level of capital investment spent a longer time fishing, had a higher level of deliveries and more deliveries per week than did low income vessels. Fishing for longer periods of time with greater intensity, these capital intensive vessels were able to greatly increase their rate of return on capital. The wide dispersion in the amount of time spent fishing for all vessel categories indicates that vessels can circumvent regulations restricting the number of vessels by fishing for longer periods of time with each vessel in the fishery. The increasing use of combination gear to fish salmon since 1969 can be taken as evidence of this. The positive correlation between rate of return and time spent fishing illustrates the efficiency reducing impact of regulations that have constrained the amount of time a vessel can participate in the fishery.

Trollers

Trollers specialize in catching chinook and coho salmon primarily for the fresh/frozen market. Data for 1976,[22] for example, show trollers caught 80.7% and 74.3% of chinook and coho salmon. respectively, while accounting for only 7.4%of pink salmon, 2.2% of sockeye and .4% of chums. Note, however, that Table IV-1 shows that trollers are taking an increasingly large percentage of pink salmon. Generally, the troll fleet has accounted for between 25% and 30% of total salmon landings.

While trollers have the lowest landings of any gear type, they have, since 1975, received the largest share of gross income of any gear type in the salmon fishery. Their share of gross income in 1977[23] was 36.1% just.3% greater than the share of gillnetters. Higher quality landings of the most valuable species (coho and chinook) and the fact that they face more competitive buyers than gillnetters or seiners are explanations for their large share of gross income.

Again, trollers can be separated into single and combination gear vessels. As with seiners and gillnetters the number of single gear vessels has declined and the number of combination vessels risen over the 1967-1977 period.[24] In 1967 there were 2,187 single gear trollers but only 1,708 in 1977 while for combination vessels the number rose from 126 to 322 in 1977.

Single Gear Trollers

While the number of vessels in this fishery dropped by almost 500 between 1967 and 1977 their average length, net tonnage, horsepower, and number of days fished per vessel all rose appreciably.[25] Estimates of real capital employed show single gear trollers which the largest appreciation over the 1969-1977 period of between 52% and 65%. Given this data it is difficult to come to a conclusion concerning the change in the fishing power of the fleet over this period.

The average rate of return on capital invested for single operation trollers was the highest of any single operation gear type, averaging 9.8%. As shown in Table IV-15, the dispersion in the rates of return for various levels of capital invested were also larger than for any other gear type. Except for vessels with income less than $5,000 per year, there does not seem to be a high correlation between capital invested and weeks spent fishing although highly capitalized boats had twice the number of crewmen than did those with a low level of capital investment and spent an average of five days per week fishing compared to three for vessels with low capital investment. Despite this constancy in time spent fishing capital intensive boats were able to earn dramatically higher rates of return on capital by fishing more intensively in a given time period.

Combination Trollers

As stated above the number of vessels in this category increased dramatically between 1976 and 1977 -- by over 150%. There were no appreciable increases in the other fleet characteristics,[26] although real capital employed did rise by between 13% and 23%. While total average days fished actually fell, average days fished for salmon rose slightly. It appears that the amount of effort applied by trollers in the salmon fishery rose substantially between 1967 and 1977.

In addition to fishing for salmon, these trollers also engaged in the herring, halibut, ground fishery and other fisheries.[27] Over the eleven year period days fished for salmon was between 55% and 75% of the total days fished accounting for between 30% to 60% of troll gross income. Over these years the percentage of time and income of trollers in the salmon fishery has risen. The other major source of income for trollers has been the halibut fishery which in 1972 accounted for 22.5% of days fished and 60.1% of average gross income. The importance of longlining has fallen off since then, however, with 15% of days fished and 21% of gross income coming from halibut in 1977.

a) Primary Sector - Footnotes

1 see Table IIa-1

2 see Table IIa-2

3 for an analysis see M. Shaffer, An Economic Study of the Structure of the B. C. Salmon Industry, p. 77

4 see Table IIa-5

5 see Table IIa-6

6 see Table IIa-7

7 see G. S. Gislason, Background Reports Prepared for the British Columbia Coastal Fisheries Licensing Study, Report No. 2, 1976.

8 see Table IIa-8

9 see Table IIa-9

10 see Table IIa-10

11 see Table IIa-10

12 for more detail, Gislason, Op.cit., Report No. 1.

13 see Table IIa-12

14 see Table IIa-13

15 see Table IIa-14

16 see Table IIa-15

17 see Table IIa-14

18 see Table IIa-17

19 see Table IIa-19

20 see Tables IIa-15 and IIa-20

21 G. S. Gislason, Op. cit., Report No 2, pp 16-17.

22 M. Shaffer, Op. cit., p. 27

23 see Table IIa-2

24 see Table IIa-2
25
25 see Table IIa-22

26 see Table IIa-23

27 see Table IIa-24

LIST OF TABLES

TABLE IIa-1

Percentage Landings of Salmon by Species and Different Gear Types - Four Year Averages, 1960 - 1977
Percentage of Total Landings by Weight

	Sockeye	Coho	Pinks	Chums	Chinook	All Species
Gillnet						
1960-1963	81.3	25.1	32.3	57.5	30.3	41.7
1964-1967	75.8	25.0	29.9	53.8	25.5	39.7
1968-1971	69.2	22.0	25.6	62.3	19.4	40.6
1972-1975	64.8	18.3	19.6	51.1	15.4	38.6
1976	62.0	12.6	17.7	44.3	13.2	30.9
1977	62.0	13.6	22.1	53.4	15.0	33.4
Seine						
1960-1963	18.0	12.8	62.1	42.4	4.9	39.1
1964-1967	21.9	11.4	59.3	45.7	5.6	33.1
1968-1971	23.6	11.9	61.4	37.1	7.6	32.6
1972-1975	28.9	16.6	67.4	48.5	6.9	38.3
1976	35.6	12.8	75.0	55.3	6.3	43.4
1977	35.9	20.1	51.8	44.8	12.3	37.7
Trall						
1960-1963	.7	62.1	5.6	.3	64.8	19.2
1964-1967	2.3	63.6	10.8	.5	98.9	27.2
1968-1971	7.2	66.0	12.9	.6	73.0	26.8
1972-1975	6.3	65.1	13.0	.4	77.7	23.1
1976	2.4	66.3	26.1	1.8	72.7	28.9

Source: S. Sinclair, A Licensing and Fee System for the Coastal Fisheries of British Columbia, December 1978, Vol. 1, p. 74.

TABLE IIa-2

Gross Income and Percentage Share of Gross Income from the Salmon Fishery by Gear Type, 1967-1977

Year	SEINERS		GILLNETTERS		TROLLERS	
	Gross Income ($000's)	Percent of Total	Gross Income ($000's)	Percent of Total	Gross Income ($000's)	Percent of Total
1967	9,416	26.6	16,297	46.0	9,715	27.4
1968	10,090	24.8	21,808	49.6	11,275	25.6
1969	3,811	13.8	13,007	47.2	10,750	39.0
1970	10,965	27.6	16,781	42.2	12,010	30.2
1971	11,097	25.3	17,040	38.8	15,746	35.9
1972	14,738	30.0	19,643	39.9	14,825	30.1
1973	32.376	33.6	40,991	42.5	23,078	23.9
1974	20,935	28.4	29,086	39.5	23,685	32.1
1975	12,036	26.1	16,692	36.2	17,346	37.7
1976	27,181	29.7	30,274	33.1	34,046	33.2
1977	30,686	28.1	39,082	35.8	39,382	36.1

Source : Various tables of the Sinclair Report, December 1978, Vol. II.

TABLE IIa-3

Average Salmon Prices by Species, 1967-1977

Year	Cents Per Pound				
	Spring	Sockeye	Coho	Pink	Chum
1967	43.5	37.4	31.6	12.9	13.3
1968	44.6	37.8	31.3	12.6	13.6
1969	49.5	38.7	36.1	16.1	20.9
1970	55.8	39.5	41.8	15.1	17.4
1971	48.0	41.6	34.2	16.8	18.0
1972	54.5	42.8	47.6	16.6	20.4
1973	84.0	55.8	76.2	26.7	45.2
1974	82.0	61.4	60.5	23.4	38.8
1975	75.7	65.3	72.7	30.6	60.7
1976	133.7	75.9	103.8	32.2	61.6
1977	142.2	84.0	104.3	40.8	59.4

Source: The Sinclair Report, Vol. II, p. 24.

TABLE IIa-4

1976 Landed Prices by Species and Gear Type

($ per pound)

	Sockeye	Pink	Chum	Coho	Chinook
Gillnet	.76	.31	.61	.69	1.08
Seine	.74	.30	.61	.60	.89
Troll*	1.15	.56	.71	1.37	1.67
	(.98)	(.48)	(.60)	(1.16)	(1.42)

*Troll prices are dressed per pound. Estimated prices per round pound are bracketed below.

Source: M. Shaffer, An Economic Study of the Structure of the British Columbia Salmon Industry, April 1979, p.

TABLE IIa-5

Single Gear Salmon Seiners Characteristics, 1967-1977

Year	1 No.	2 Average Length	3 Net Tonnage	4 Average Horsepower	5 Average Age	6 Average Market Value (000)	7 Average Gross Fish Income (000)	8 Average Days Fishing
1967	232	50.5	22.8	142	31.8	33.1	20.6	36.0
1968	271	52.8	27.2	158	31.0	41.4	29.5	41.3
1969	286	53.8	28.3	165	31.7	45.8	10.7	25.5
1970	293	53.4	27.9	164	33.8	45.9	26.7	40.3
1971	253	54.5	28.1	168	33.5	48.4	28.7	32.3
1972	247	52.4	24.1	150	34.9	44.9	35.8	40.8
1973	228	53.9	24.0	156	35.3	56.5	67.9	40.7
1974	233	53.9	23.5	164	33.5	105.0	38.6	27.5
1975	230	54.1	24.2	173	32.6	105.1	20.0	21.8
1976	226	52.5	22.8	178	34.7	110.4	49.0	32.0
1977	221	53.2	21.5	177	36.4	117.3	50.2	35.9

Source: The Sinclair Report, December 1978, pp. 15 and 28.

TABLE IIa-6

Electronic Equipment on Licensed Fishing Vessels in the B.C. Fishing Industry, Selected Years 1969-1977

Type of Electronic Equipment	1969	1972	1976	1977
Radiophones	5,137	5,056	6,608	9,149[a]
Automatic Pilots	2,102	2,168	2,458	2,481
Loran Sets	672	965	1,389	1,509
Radars	906	1,581	2,866	3,126
Direction Finders	997	906	723	665
Echo Sounders	4,715	4,722	5,555	5,594
Sonars	52	46	170	271

[a]1977 not comparable to previous years for radiophones.

Source: The Sinclair Report, December 1978, p. 102.

TABLE IIa-7

Estimates of Real Capital Employed in the Salmon Fishery by Gear and Operation Class

Vessel Classification	Real Capital Employed Per Vessel		
	1969	1977	% Change
	($000's 1969)		
Single Gear:			
Salmon Seine	46	45 - 50	-2% to 8%
Salmon Gillnet	7	8 - 9	10% to 29%
Troll	14	21 - 22	52% to 65%
Combination Gear:			
Salmon Seine	59	88 - 96	49% to 63%
Salmon Gillnet	13	14 - 16	15% to 27%
Troll	21	24 - 26	13% to 23%

Source: The Sinclair Report, Vol. I, December 1978, p. 107.

TABLE IIa-8

Estimated Returns to Capital and Labour from Single Operation
Salmon Sein Vessels -- 1976

	Income Class				
	<$40,000	$40,000-59,999	$60,000-79,999	$80,000 Plus	All Vessels
Boat and Net Owner:					
Net Returns ($)	200.0	13,500.0	21,300.0	44,950.0	12,675.0
Capital Invested ($000)	123.8	145.2	176.3	183.2	146.3
Rate of Return (%)	0.0	9.0	2.0	25.0	9.0
Captain:					
Earnings ($)	3,400.0	6,500.0	9,200.0	13,525.0	6,450.0
Weeks Fished	11.2	15.1	16.4	17.8	14.2
Weekly Earnings ($)	300.0	425.0	550.0	750.0	450.0
Full-Time Crew Member:					
Earnings ($)	2,825.0	5,450.0	7,725.0	11,400.0	5,400.0
Weeks Fished	11.2	15.1	16.4	17.8	14.2
Weekly Earnings ($)	250.0	350.0	475.0	650.0	375.0

Source: G.S. Gislason, Background Reports Prepared for the B.C. Coastal Fisheries Licensing Study, Vol. I, p. 14.

TABLE IIa-9

Selected Characteristics of Single Operation Seine Vessels - 1976

Average Characteristic	Income Class				
	<$40,000	$40,000-59,999	$60,000 79,999	$80,000 Plus	All Vessels
No. of Vessels	76.0	93.0	41.0	16.0	226.0
Length in Feet	51.5	54.3	56.9	55.1	53.9
Net Tonnage	20.9	23.2	24.8	23.6	23.0
Age	40.0	35.7	33.9	14.6	34.7
Weeks Fished	11.2	15.1	16.4	17.8	14.2
Crew Size	4.9	4.9	4.9	4.9	4.9
No. of Deliveries	25.2	34.0	37.0	40.0	32.0

Source: G.S. Gislason, Vol. I, p. 5.

TABLE IIa-10

Average Characteristics of Combination Seiners, 1967 - 1977

	1	2	3	4	5	6	7	8	9		
	No. of Vessels	Length in Feet	Net Tonnage	Horse-Power	Age in Years	Market Value ($000)	Gross Income ($000)	Days Fished	Percentage of Gross Income From		
									Salmon	Herring	Halibut
Year	All Columns Except 1 Are Averages										
1967	181	59.9	40.8	220	23.1	60.6	45.9	49.7	56.0	17.2	21.4
1968	120	51.7	25.8	170	25.7	43.3	37.1	59.2	65.0	2.7	18.3
1969	84	52.8	28.7	187	24.6	59.1	28.1	52.9	32.4	2.9	41.3
1970	132	55.5	33.0	202	24.5	62.9	51.7	68.5	45.7	1.9	42.8
1971	152	52.7	27.8	184	24.5	53.8	45.5	62.4	55.4	11.2	25.3
1972	146	57.4	32.4	203	28.5	61.0	61.6	58.1	65.4	16.1	14.6
1973	228	57.6	35.5	214	26.5	93.7	124.9	64.5	59.4	26.2	9.6
1974	255	59.3	38.6	221	27.1	167.0	80.1	46.3	58.6	29.5	6.1
1975	242	61.0	34.7	238	25.5	172.6	74.1	37.4	41.6	37.4	13.8
1976	283	59.6	34.7	255	24.1	191.7	119.1	48.4	47.9	33.1	15.0
1977	293	61.6	35.8	274	23.6	218.5	146.3	53.8	45.7	41.6	6.6

Source: The Sinclair Report, December 1978, Vol. II, various tables.

TABLE IIa-11

Days Fished (%) and Gross Income (%) by Combo. Seiners in the Salmon Herring and Halibut Fisheries
(all are in %)

Year	Salmon		Herring		Halibut	
	Days Fished	Gross Income	Days Fished	Gross Income	Days Fished	Gross Income
1967	70.6	56.0	1.4	17.2	15.9	21.4
1968	67.4	65.0	2.2	2.7	11.5	18.3
1969	42.3	32.4	1.9	2.9	21.4	41.3
1970	50.8	45.7	3.8	1.9	23.9	42.8
1971	59.9	55.4	4.2	11.2	20.7	25.3
1972	73.7	65.4	6.2	16.1	11.5	14.6
1973	69.6	59.4	5.4	26.2	9.9	9.6
1974	73.4	58.6	13.0	29.5	4.5	6.1
1975	61.9	41.6	8.9	37.4	10.9	13.8
1976	59.5	47.9	9.9	33.1	18.6	15.0
1977	63.9	45.7	13.2	41.6	12.3	6.6

Source: The Sinclair Report, Vol. II, p. 29.

TABLE IIa-12

Estimated Economic Profile of Average Combination Salmon-Roe Herring Seine Fishing Vessels, 1976

	Salmon Operation	Herring Operation
Market Value of Asset ($000's)	232.5	65.0
Week's Fished	15.8	3.6
Crew Size	5.3	5.9
No. of Deliveries	30.0	5.6
Total Gross Income	101,725.0	67,850.0
Operating Expenses	60,200.0	37,725.0
Depreciation	7,725.0	9,500.0
Net Return to Owner	24,625.0	9,325.0
Net Return to Operator	9,175	11,300

Source: G.S. Gislason, Vol. I, p. 21.

TABLE IIa-13

Estimated Returns to Capital and Labour from Combination Salmon-Herring Seine Fishing Operations, 1976

Average Characteristic	Fishing Operation		
	Salmon	Herring	Total
Boat and Net Owner:			
Net Return ($)	24,625.0	9,325.0	33,950.0
Capital Invested ($000's)	232.5	65.0	297.5
Rate of Return (%)	232.5	14.0	11.0
Captain:			
Earnings ($)	9,175.0	11,300.0	20,475.0
Weeks Fished	15.8	3.6	19.4
Weekly wage ($)	575.0	3,150.0	1,050.0
Full-Time Crew:			
Earnings ($)	7,625.0	5,525.0	13,150.0
Weeks Fished	15.8	3.6	19.4
Weekly Wage ($)	475.0	1,525.0	675.0

Source: G.S. Gislason, Vol. I, p. 21.

TABLE IIa-14

Number of Single Gear and Combination
Gill Netters and Total, 1967-1977

Year	Single Gear	Combination	Total
1967	2,041	1,749	3,790
1968	2,146	1,614	3,760
1969	2,462	961	3,423
1970	2,307	1,189	3,496
1971	2,144	1,071	3,215
1972	2,065	957	3,022
1973	1,798	1,151	2,949
1974	1,944	1,024	2,968
1975	1,690	1,198	2,878
1976	1,562	1,294	2,856
1977	1,524	1,308	2,832

Source: The Sinclair Report, December 1978, Vol. II, pp. 31-32.

TABLE IIa-15

Single Gear Gillnetters 1967-1977

Year	1 No. of Vessels	2 Length in Feet	3 Net Tonnage	4 Horse-Power	5 Age in Years	6 Market Value	7 Gross Income	8 Number of Deliveries
	All Columns Except 1 are Averages							
1967	2,041	30.2	4.2	100	14.6	5.4	3.5	32.2
1968	2,146	30.3	4.4	105	14.8	5.6	5.0	35.5
1969	2,462	31.0	4.6	117	14.6	7.1	3.1	28.0
1970	2,307	31.0	4.5	120	15.4	7.4	3.7	33.2
1971	2,144	31.3	4.7	126	15.6	8.2	4.2	33.0
1972	2.065	31.6	5.0	132	15.4	9.0	5.4	35.7
1973	1,798	31.8	5.2	138	15.4	12.4	12.0	36.8
1974	1,944	32.3	5.6	147	14.8	22.8	8.3	30.7
1975	1,690	32.1	5.6	150	15.3	20.5	4.5	21.4
1976	1,562	32.0	5.3	155	16.2	21.5	8.5	27.7
1977	1,524	32.0	5.6	162	16.4	23.8	11.8	31.3

Source: The Sinclair Report, December 1978, Vol. II, pp. 18 and 31.

TABLE IIa-16

Estimated Returns to Capital from Single-Operation Salmon Gillnet Vessels, 1976

	Initial Payment Income Class				
	<$5,000	$5,000-9,999	$10,000-19,999	≥$20,000	All
Net Returns to Operator	1,025.0	4,000.0	8,275.0	18,575.0	4,900.0
Capital Investment ($000's)	17.7	23.9	30.5	43.3	24.7
Opportunity Cost of Labour at $260/wk	1,534.0	3,770.0	4,833.0	5,023.0	3,276.0
Return to Capital	-509.0	230.0	1,442.0	13,552.0	1,674.0
% Return on Investment	-2.9	.1	11.3	31.3	6.8
No. of Vessels	484	551	445	72	1,562

Source: G. S. Gislason, Vol. II, p. 9

TABLE IIa-17

Average Characteristics of Combination Salmon Gillnetters, 1967-1977

Year	1 No. of Vessels	2 Length in Feet	3 Net Tonnage	4 Horse-Power	5 Age in Years	6 Market Value	7 Gross Income	8 Days Fished
	All Columns Except 1 are Averages							
1967	1,749	31.9	5.3	109	13.4	8.8	5.7	55.9
1968	1,614	32.2	5.6	114	13.2	9.2	7.4	56.9
1969	961	33.5	6.2	127	11.5	12.5	6.9	57.2
1970	1,189	33.6	6.1	128	12.4	13.5	8.0	63.0
1971	1,071	34.1	6.4	130	13.2	14.5	8.3	60.5
1972	957	34.0	6.5	134	13.6	15.3	11.1	65.7
1973	1,151	34.3	6.7	138	14.6	21.5	19.1	62.3
1974	1,024	34.6	6.9	144	14.3	35.5	14.1	53.3
1975	1,198	34.9	7.0	158	13.3	33.4	9.8	44.4
1976	1,294	34.7	6.6	162	13.9	35.5	15.9	53.8
1977	1,308	34.4	6.7	158	15.1	37.3	18.7	55.9

Source: The Sinclair Report, December 1978, Vol. II, pp. 19 and 32.

TABLE IIa-18

Estimates of Weeks Fished and No. of Deliveries for Single Operation and Combination Gillnet/Troll Vessels 1976 (by Income Class)

	Initial Payment Income Class				
	<$5,000	$5,000-9,999	$10,000-19,999	$20,000 +	All
Weeks Fished:					
Single Gear	5.9	14.5	16.9	16.1	12.6
Combo. Gear:					
Gillnet	3.0	10.1	11.8	12.6	10.4
Troll	4.3	5.6	8.8	9.2	7.6
Total	7.3	15.7	20.6	21.8	18.0
Deliveries:					
Single Gear	11.8	28.9	39.7	50.8	31.3
Combo. Gear:					
Gillnet	6.0	22.8	29.6	37.9	26.6
Troll	12.9	16.8	30.8	36.9	26.6
Total	18.9	39.6	60.4	74.8	53.2
Deliveries/week:					
Single Gear	2.00	1.99	2.35	3.16	2.48
Combo. Gear:					
Gillnet	2.00	2.26	2.51	3.01	2.56
Troll	3.00	3.17	3.50	4.01	3.50
Other	2.59	2.52	2.93	3.43	2.96

Source: G. Gislason, January 1979, No. 2, various pages.

TABLE IIa-19

Combination Gillnet Vessels, Days Fished and Gross Income by Gear and Type of Fish in Percentages of Total, 1967 - 1977 *

Year	Salmon						Herring		Halibut	
	Gill Net		Troll		Total					
	Days Fished	Gross Income	Days Fished	Gross Income	Days Fished	Gross Income	Days Fished	Gross Income	Days Fished	Gross Income
1967	58.9	71.9	30.2	21.1	89.1	93.0	.7	-	3.0	3.5
1968	61.2	75.7	30.8	18.9	92.0	94.6	.2	-	2.5	4.1
1969	50.7	65.2	30.1	15.9	80.8	81.1	.4	-	7.0	13.0
1970	54.3	67.5	32.7	21.3	87.0	88.8	.3	-	6.0	8.8
1971	50.1	66.3	40.0	26.5	90.1	92.8	.2	-	.6	6.0
1972	50.1	60.4	37.1	21.6	87.2	82.0	.3	-	6.7	13.5
1973	52.0	72.8	34.8	17.8	86.8	90.6	.6	1.6	6.7	6.3
1974	50.3	65.3	39.2	24.8	89.2	90.1	1.1	2.8	3.0	4.3
1975	44.1	58.2	41.9	24.5	86.0	82.7	1.6	4.1	5.0	10.2
1976	48.3	56.6	38.9	26.4	87.2	83.0	1.1	3.1	7.3	12.0
1977	47.6	62.6	38.8	24.1	86.4	86.7	.5	1.1	8.8	8.0

Source: The Sinclair Report, December 1978, Vol. II, p. 32.

*Does not include the herring roe fishery.

TABLE IIa-20

Estimated Returns to Capital from Salmon Gillnet-Troll Fishing Operations, 1976

	Initial Payment Class				
	<$5,000	$5,000-9,999	$10,000-19,999	$20,000	All
Net Return to Operator	1,000	4,450	8,925	18,875	8,725
Capital Investment	20.3	27.2	38.6	55.1	36.7
Weeks fished	7.3	15.7	20.6	21.8	18.0
Opportunity Cost of Labour at $260/wk	1,898	4,082	5,892	7,368	5,148
Return to Capital Investment	-898	368	3,033	11,507	3,577
Rate of Return	-4.4%	1.4%	7.9%	20.9%	9.8%

Source: G.S. Gislason, January 1979, No. 2, pp. 11 and 14.

TABLE IIa-21

Number of Single Gear and Combination Trollers and Total, 1967 - 1977

Year	Single Gear	Combination	Total
1967	2,187	126	2,313
1968	2,217	132	2,349
1969	2,211	126	2,337
1970	2,138	128	2,266
1971	2.046	141	2,187
1972	1,957	131	2,088
1973	1,580	209	2,789
1974	1,563	245	1,808
1975	1,540	230	1,770
1976	1,602	279	1,881
1977	1,708	322	2,030

Source: The Sinclair Report, Vol. II, pp. 21-22.

TABLE IIa-22

Single Gear Troller Characteristics, 1967-1977

Year	1 No. of Vessels	2 Average Length	3 Net Tonnage	4 Average Horse-Power	5 Average Age	6 Average Market Value	7 Average Gross Income	8 Average No. of Days Fished
1967	2187	31.9	6.2	7.9	17.6	11.4	4.4	51.8
1968	2217	32.4	6.4	8.3	17.6	11.3	5.2	55.2
1969	2211	33.7	6.9	89	18.7	13.5	5.2	54.9
1970	2138	33.9	7.0	91	19.5	14.4	5.7	54.7
1971	2046	34.5	7.3	94	20.4	15.9	7.9	61.8
1972	1957	35.1	7.8	97	20.5	18.4	8.7	59.8
1973	1580	35.4	7.8	102	21.2	26.8	14.1	61.1
1974	1563	35.5	7.9	101	22.0	39.4	13.9	60.6
1975	1540	35.9	8.0	105	22.8	37.1	10.4	58.3
1976	1602	36.2	7.8	108	22.6	43.8	19.4	60.3
1977	1708	36.3	7.9	115	23.2	50.1	21.0	65.4

Source: The Sinclair Report, Vol. II, p. 21.

TABLE IIa-23

Combo. Gear Troller Characteristics, 1967-1977

Year	1 No. of Vessels	2 Average Length	3 Net Tonnage	4 Average Horse-Power	5 Average Age	6 Average Market Value	7 Average Gross Income	8 Average No. of Days Fished
1967	126	33.7	7.6	78	18.5	12.4	8.3	72.3
1968	132	42.6	16.4	124	19.5	29.6	19.6	76.7
1969	126	37.2	10.1	93	16.9	21.4	13.2	77.5
1970	128	39.4	11.2	107	18.2	25.8	13.6	76.2
1971	141	40.6	12.8	115	21.3	27.1	20.5	77.3
1972	131	39.9	13.6	115	19.7	30.0	31.6	72.3
1973	209	40.7	11.5	122	20.0	44.2	30.0	67.2
1974	245	41.3	11.0	118	19.0	53.7	23.6	67.2
1975	230	38.4	10.7	118	17.9	54.4	19.8	69.0
1976	279	39.5	10.5	125	19.7	63.9	32.8	70.6
1977	322	37.7	10.0	123	18.8	60.1	29.7	64.5

Source: The Sinclair Report, Vol. II, p. 22.

TABLE IIa-24

Average Days Fished and Gross Income by Species and Gear for Combination Troll Vessels, 1967-1977 (Percentages)

	Salmon		Herring				Halibut					
	Troll		Seine		Gillnet		Longline		Trawl		Other	
Year	D.F.	G.I.	D.F.	G.I.	D.F.	G.I.	D.F.	G.I.	D.F.	G.I.	D.F.	G.I.
1967	63.5	51.8	0	1.2	.1	-	8.9	19.3	4.6	7.2	23.9	20.5
1968	55.2	30.1	.1	-	0	-	11.3	30.1	18.1	34.2	15.3	5.1
1969	56.4	47.7	.1	.8	.3	-	10.1	25.0	10.6	17.4	22.5	9.1
1970	55.9	48.5	.3	-	.1	-	11.9	28.7	8.3	14.0	23.5	8.8
1971	61.2	42.4	.3	1.0	.1	-	14.5	35.6	9.7	16.1	14.2	4.4
1972	60.9	31.7	.1	1.0	.1	-	22.5	60.1	4.8	4.4	11.5	2.9
1973	63.4	43.7	.2	2.3	1.6	2.0	22.2	43.7	2.2	2.0	10.3	6.3
1974	74.7	55.1	.5	4.2	1.3	3.4	8.9	15.7	4.3	13.6	10.3	8.5
1975	72.2	57.6	-	2.5	3.6	8.1	9.3	19.2	3.8	4.6	11.3	8.6
1976	65.6	51.8	.3	3.1	3.5	6.4	14.9	21.0	4.8	6.1	10.8	11.3
1977	55.0	42.8	.3	2.4	2.2	4.7	23.0	24.6	4.3	6.4	15.2	19.2

Source: The Sinclair Report, Vol. II, p. 35.

TABLE IIa-25

Estimated Returns to Capital from Single Operation Troll Fishing Vessels - 1976

	Initial Payment Income Class					
	< $5,999	$5,000-$9,999	$10,000-$19,999	$20,000-$29,999	$40,000+	All
Net Return	-1,000	3,500	6,500	15,275	35,250	10,325
Capital Invested ($000)	15.8	29.4	44.7	62.0	99.9	46.8
Weeks Fished	5.9	17.5	20.2	20.1	18.9	15.8
Crew Size	1.0	1.2	1.3	1.6	1.9	1.4
Opportunity Income at $260/week	$1,534	$5,460	$6,828	$8,362	$9,337	$5,751
Return to Capital Invested	$-2,534	$-1,960	$-328	$-6,913	$25,913	$4,574
Rate of Return (%)	-16.0	-6.7	-.7	11.2	25.9	9.8

Source: G. S. Gislason, No. 3, p. 4.

TABLE IIa-26

Number and Percentage of Licensed Vessels Owned by Processing Companies by Gear Classification, 1969-1977

	1969	1970	1971	1972	1973	1974	1975	1976	1977
Licensed Salmon Seiners:									
Number Owned	164	164	126	127	130	149	134	131	121
Percentage Owned (%)	(44)	(39)	(31)	(32)	(29)	(31)	(28)	(26)	(24)
Licensed Salmon Gillnetters:									
Number Owned	556	499	447	427	404	444	408	435	428
Percentage Owned (%)	(16)	(14)	(14)	(14)	(14)	(15)	(14)	(15)	(15)
Licensed Trollers:									
Number Owned	2	1	12	7	4	4	6	2	8
Percentage Owned (%)	(0)	(0)	(1)	(0)	(0)	(0)	(0)	(0)	(0)

Source: The Sinclair Report, Vol. II, December 1978, p. 50

TABLE IIa-27

Estimated* Indebtedness of Licensed Vessels in Total and to Processing Companies, 1970-1977

	1970	1971	1972	1973	1974	1975	1976	1977
Total Vessels Reporting Debt	2819	2568	2357	2136	2669	2713	2879	2682
Percentage Reporting Debt	41	39	38	29	38	37	38	41
Number Reporting Debt to Processing Companies	1302	1022	770	569	652	612	478	294
Percentage Reporting Debt to Processing Companies	19	15	12	8	9	8	6	5
Amount of Total Debt ($ millions)	22.2	21.2	23.2	26.0	45.8	60.4	69.0	76.7
Percentage of Total Debt to Total Vessel Value	22	20	21	16	17	23	23	24
Amount of Debt to Companies ($ millions)	7.9	6.4	5.4	5.1	6.8	11.1	7.8	5.0
Debt to Companies as a Percentage of Total Debt	36	30	23	20	15	18	11	7

Source: The Sinclair Report, Vol. II, December 1978, p. 124

* These figures are based on data given by fishermen in their license applications. Processing Company debt does not include debt jointly assumed by company and a financial institution.

b) Secondary Sector

The Economic Implications of Industry Structure

Most economic analyses of the fishing industry, assume at least implicitly, the existence of perfect competition in all sectors of the fishery. This entails:

1) A large number of buyers and sellers of fish acting independently so no single agent or coalition of agents has an influence over price.
2) The lack of entry or exit barriers.
3) Producers and consumers have perfect information concerning the price, physical characteristics, and availability of each commodity.

Given this assumption, the market equilibrium without government intervention will be one where most of the potential rent from the fish resource is dissipated in the harvesting sector.

An industry structure characterized by perfect competition is only one possibility, however. A fishery could equally be characterized by monopsony (one buyer of fish), bilateral monopoly (one seller and one buyer of the fish) or, more likely, some characterization between these two polar cases. Each separate characterization of industrial structure has different, although not always predictable, implications for pricing and investment behaviour as well as other concerns such as rent creation and distribution.

Clark and Munro have shown that a monopsonistic processing sector would lead to socially optimal management of the resource only under special circumstances.[1] In fact, if private and social discount rates are equal and the marginal cost of fishing is upward sloping the monopsonistic solution would be more conservationist (that is, fishing would occur at a higher stock level) than the social optimum. A bilateral monopoly model, while not arriving at the socially optimal production level, would appear to imply a different and superior solution than the competitive case.

The actual structure of most fisheries lies somewhere between the polar cases of perfect competition and monopoly-monopsony.

In general, the processing sector is often characterized by oligopsony (defined here as a few important buyers[2] of fish) while the structure of the harvesting sector varies in different areas and fisheries. Entry barriers in the processing sector exist in differing degrees in every fishery while entry to the harvesting sector is limited by regulation in many fisheries and further constrained due to high entry costs. Exit from both sectors, especially the harvesting sector, is often constrained due to sociological and economic considerations.

The implications of dropping the competitive assumptions underlying most fisheries models are the following:

1) The competitive model predicts that most of the potential rent from the resource will be dissipated in the harvesting sector of the fishery. If the processing sector is monopsonistic, however, it will extract resource rent from the industry leaving none for the fishermen. Note that in both cases little or no rent is earned in the harvesting sector. This has led Clark and Munro to caution, "If the standard single-sector model is employed to analyze a fishery having a processing sector with effective monopsony power and a competitive harvesting sector, a biased view may be obtained of the state of the industry. The fishery examined in this manner may appear to exhibit all of the symptoms of dissipation of economic rent under

bionomic equilibrium, while in fact being operated at or close to the social optimum."[3]

2) If a particular fishery is characterized by some degree of monopsony power in the processing sector, it follows that some of the potential industry rent will accrue to this sector. In designing a regulatory program to mitigate excessive investment in a fishery, fisheries managers will therefore have to be aware that rent dissipation can occur in both the harvesting and processing sectors. If the polar case of only one fish buyer exists, any deviation from the socially desirable level of rent creation and distribution must be corrected by altering processing activity. In the more realistic case of oligopsony substantial rent dissipation can occur in the processing sector as processors attempt to strengthen entry barriers to potential entrants. This can be done by limit pricing or by non-price activities such as vertical integration or establishing buyer-seller ties.

3) License restriction on processors could control entry into the processing sector, strengthen the monopsony power of licensed companies. Taxes could then be utilized to pursue the distributional objectives of society.

Structure of the Processing Sector

A large number of firms, 108 in 1977, purchase salmon directly from fishermen. These buyers can be divided into three basic categories: buyers with processing facilities, buyers without processing facilities affiliated with processors and independent buyers without processing facilities. The vast majority of salmon purchased from fishermen are either canned or enter the fresh/frozen salmon market. In recent years, approximately 56% of salmon production has been exported although a much larger percentage of fresh/frozen than canned production has gone into exports. Several aspects of the processing industry are of key importance for this study. These are the degree of concentration, vertical integration and the degree of capacity utilization in the industry.

Although there are a large number of salmon buyers, a few buyers account for the majority of salmon purchases. In 1977, for example, the top three non-co-op firms purchased over 50% of total landings.[4] While there has been a significant increase in the number of salmon buyers since the late 1960's,[5] the decline in purchases accounted for by large firms has been moderate. The major expansion in the number of buyers has been in the cash buyer category which, in 1977, only accounted for 4% of raw salmon purchases.

Concentration in the secondary sector varies by area, by species of fish purchased, by gear type and by the end product of the salmon purchased. These factors are, of course, heavily interrelated. Tables IIb-3 to IIb-6 document the variation in concentration according to each of the above factors. While this variation is significant in some cases, concentration in all aspects of the fishery is high.

An important aspect of the salmon industry is the vertical integration between the secondary and primary sectors of the fishery. This intergration can take the form of direct ownership of vessels, financing of vessels and equipment and the provision of services to fishermen by processors. A substantial proportion of the fishing fleet, 12% in 1977, is owned by processing companies. Note that company ownership of vessels beyond this level is prohibited by regulation. Direct ownership of vessels by companies varies widely by gear type, being estimated at 24% of the seine vessels, 15% of gillnet vessels and 1/2% of troll vessels.[6] Company financing of vessels has also been extensive but has decreased markedly in recent years.[7] Vertical integration is highest for the net-caught canned species and the larger firms in the industry rely most heavily on company owned and controlled vessels for their supply.[8]

The extent of capacity utilization in the processing sector was estimated by Underwood, MacLellan and Associates to be less than 50%.[9] Table IIb-9 presents estimates of capacity utilization by area and end product based on a 7 day per week with two 8-hour shifts per day operation. While the concept of over-capacity in processing facilities from an economic standpoint has not been clarified, it appears from available data, that substantial over-investment has occurred. In the canning sector capacity increased from 1968 to 1977 by an estimated 20% due to investments in high speed equipment. Although no data is available on investment in freezing and storage facilities it is apparent that it has increased dramatically since the late 1960's.

The major breakdown of the secondary sector is between the canning and fresh/frozen salmon producers. Of 47 salmon processors listed in 1977, 19 were involved in canning while 23 processors were concentrated solely in freezing. The important difference between the canning and fresh/frozen sectors of the industry is the degree of competition in each. Table IIb-10 illustrates that while both sectors have a high degree of concentration, the top three firms in the canning industry accounted for over 80% of the value of salmon production while the top three firms in the fresh/frozen sector was less than 50%. The explanation for this difference lies mainly in the higher entry barriers in the canned salmon sector compared to the fresh/frozen sector.

Figures on the utilization of Pacific salmon show that the quantity of production in the fresh/frozen sector is increasing relative to that in the canning sector.[10] The proportion of total production accounted for by canneries had traditionally ranged between 70% and 75% but had decreased to just over 50% by 1978. Trends in real wholesale price indices from the period 1961-1976 show that the annual percentage increases for fresh and frozen products have outstripped prices for canned products by a considerable margin.[11] This difference in price trends helps to explain the switch toward fresh/frozen production.

Impact of Structure on the Behaviour of the Industry

From the above discussion, the structure of the processing sector can be characterized as oligopsonistic. This is true for the industry as a whole but especially for the canning sector where entry barriers are higher than in the fresh/frozen sector. Impacts of this structure on the behaviour of the industry are contained in a report by Marvin Shaffer (1978). His main points are the following:

1) Some rent is being captured by the processing sector. Processors of canned products receive a higher proportion of rent than does the fresh/frozen sector of the industry. Evidence for this comes from two studies, one by Underwood, MacLellan and Associates (1976) and one by the British Columbia Select Standing Committee on Agriculture (1976). The U.M.A. study estimated gross profit margins on canned products of 26% compared to 11% for fresh/frozen products for 1974. An SSCA survey for the period 1972-1976 showed an annual average gross profit margin across all canned products of 38% compared to 27% for net-caught frozen products and 18% for troll-caught frozen products. SSCA survey results for 1976 did not bear out this result as evidenced in Table IIb-13.

2) Rent is being dissipated by processors in their attempt to maintain their share of the catch and impose additional entry barriers. This rent dissipation occurs through excessive investment by processors in the harvesting sector (by direct ownership and low-cost financing) and in processing facilities.

3) An additional source of inefficiency is an inappropriate mix of output (i.e. too much canned production) from processors. Although the potential rent from the industry as a whole would increase with a shift toward more fresh/frozen produce, individual canning companies would lose some of their monopsony rents from such a shift. They use their control of the fleet to prevent such a change.

4) Control of excessive investment cannot be pursued at the harvesting level alone.

TABLE IIb-1

SHARES OF RAW SALMON PURCHASES BY BUYER CATEGORY 1973-77

	1973		1974		1975		1976		1977	
	% of Value	% of Weight	% of Value	% of Weight	% of Value	% of Weight	% of Value	% of Weight	% of Value	% of Weight
Top 3 Non-Co-op Firms	59.1	60.5	57.1	58.0	42.3	42.2	50.0	53.0	52.4	53.4
Cooperatives	8.5	7.8	10.0	9.1	18.1	19.7	11.2	9.3	13.3	12.1
Other Processors	29.2	29.4	30.8	31.1	33.2	32.9	35.5	30.9	29.1	30.5
Cash Buyers*	3.1	2.3	2.1	1.8	6.2	5.0	3.3	2.8	5.2	4.0
TOTAL	100	100	100	100	100	100	100	100	100	100

* For footnotes and sources to this and all following tables, refer to corresponding tables in the main text of this report.

Table IIb-2

Number of Buyers 1969-77*

	69	70	71	72	73	74	75	76	77
Buyers with Processing Facilities	34	40	40	39	46	46	45	42	40
Buyers with known affiliation	6	8	7	6	8	10	7	10	23
Independent Buyers	9	5	10	12	15	21	24	35	45
TOTAL	49	53	57	57	69	77	76	87	108

Source: Marine Resources Branch, B. C. Ministry of Recreation and Conservation, Fish Buying and Processing Facility Licence Files.

* This may include buyers for species other than salmon, in particular for herring. While the number for salmon alone is somewhat less than shown in the table, an examination for selected years of licences taken out during the salmon season clearly indicates that the trend would be roughly the same.

TABLE IIb-3

1976 BUYER CATEGORY SHARES OF RAW SALMON PURCHASES

BY AREA

	NORTH		CENTRAL		SOUTH		WEST COAST VANCOUVER ISLAND	
	% of Value	% of Weight	% of Value	% of Weight	% of Value	% of Weight	% of Value	% of Weight
Top 3 Non-Co-op Firms	45.2	54.4	64.8	65.0	50.6	55.6	53.4	53.7
Cooperatives	32.7	25.1	8.0	8.5	5.4	5.8	5.6	5.5
Other Processors	21.8	20.3	26.0	25.4	38.5	34.3	37.2	36.9
Cash Buyers	.3	.2	1.2	1.1	5.5	4.3	3.8	3.9
TOTAL	100	100	100	100	100	100	100	100

TABLE IIb-4

1976 BUYER CATEGORY SHARES OF RAW SALMON PURCHASES

BY SPECIE

	SOCKEYE		PINK		CHUM		COHO		CHINOOK	
	% of Value	% of Weight	% of Value	% of Weight	% of Value	% of Weight	% of Value	% of Weight	% of Value	% of Weight
Top 3 Non-Co-op Firms	61.5	60.5	57.7	60.4	54.1	57.6	44.6	47.2	49.4	52.4
Cooperatives	7.0	6.6	13.9	12.5	9.2	8.4	11.5	10.4	10.7	9.9
Other Processors	25.9	28.7	27.4	26.0	32.2	31.7	41.7	40.0	36.9	34.1
Cash Buyers	5.6	4.2	1.1	1.1	4.1	3.3	2.2	2.4	3.0	3.6
TOTAL	100	100	100	100	100	100	100	100	100	100

TABLE IIb-5

1976 BUYER CATEGORY SHARES OF RAW SALMON PURCHASES

BY GEAR TYPE*

	GILLNET		SEINE		TROLL	
	% of Value	% of Weight	% of Value	% of Weight	% of Value	% of Weight
Top 3 Non-Co-op Firms	53.7	57.9	60.4	62.6	47.3	43.6
Cooperatives	7.1	7.6	11.6	10.9	11.2	10.3
Other Processors	32.9	29.9	25.6	24.9	39.3	43.7
Cash Buyers	6.2	4.6	2.3	1.6	2.2	2.4
TOTAL	100	100	100	100	100	100

TABLE IIb-6

1976 SHARES OF SALMON PRODUCTION BY THE LARGEST FIRMS

	CANNED		FRESH/FROZEN		TOTAL*	
	% of Value	% of Weight	% of Value	% of Weight	% of Value	% of Weight
Top 3 Firms	81.7	78.0	48.7	58.0	63.5	72.8
Top 5 Firms	89.1	85.6	62.4	70.7	73.2	83.6
Top 8 Firms	96.4	94.6	74.1	83.4	81.2	89.1

Table IIb-7

Trends in Processor Financing of Fishing Vessels*

	1970	1973	1977
Conditional Sales Agreements (CSA)	439	85	122
Number of Vessels Reporting Debt to Processors+	1,472	655	475
Debt to Companies as a % of Total Fleet Reported Debt+	45.2%	25.0%	16.4%
Vessels with Debt or CSA as a % of Total Fleet	27.8%	10.0%	9.1%

Source: Department of the Environment Unpublished Vessel Licence Statistics.

* These figures are for all, including non-salmon, licenced vessels.

\+ The indebtedness to processors includes some debt which is jointly assumed by processors and financial institutions.

TABLE IIb-8a - 1976 SHARES OF RAW SALMON PURCHASES BY CONTROL CATEGORY AND SPECIES (% of landed weight)

Control Category	Sockeye	Pink	Chum	Coho	Chinook	Total*
Company Owned	21.0	27.9	20.7	7.8	4.1	19.0
Company Controlled	3.0	2.9	3.4	2.1	1.3	2.7
Independent	69.0	58.9	66.9	86.6	92.3	71.0
Residual**	7.0	10.3	9.0	3.5	2.3	7.3
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0

* Total includes purchases of steelhead.

** Residual refers to purchases of one buyer from a vessel owned by another. It appears from this data that company owned vessels do sell a considerable amount to other buyers, implying a transfer of supplies or dishonest practices by the vessel operators.

Source: Department of the Environment Sales Slip Data.

TABLE IIb-8b - 1976 SHARES OF RAW SALMON PURCHASES BY CONTROL AND BUYER CATEGORIES (% of landed weight)

Category	Top 3 Non-Co-op Firms	Cooperatives	Cash Buyers	Other Companies
Company Owned	23.5	.2	-	17.1
Company Controlled	.8	.2	-	6.7
Independent	68.1	78.1	75.3	75.2
Residual**	7.8	21.5	24.7	1.0
TOTAL	100.0	100.0	100.0	100.0

** See footnote Table IIb-8

Source: Department of the Environment Sales Slip Data.

Table IIb-9

Capacity Utilization in Canning and Freezing*

(1971-74 peak week production as a % of capacity)

	Canning	Freezing
North	38.5%	76.1%
South	50.7%	30.7%
TOTAL	44.8%	44.7%

* Based on 7-day operations and for canning, two 8-hour shifts per day.

Source: U.M.A., Competitiveness and Efficiency of the B. C. Salmon Industry, Vol. II, Table 26.

Table IIb-10

1976 Shares of Salmon Production by the Largest Firms
(% of value)

	Canned	Fresh/Frozen	Total*
Top 3 Firms	81.7%	48.7%	63.5%
Top 5 Firms	89.1%	62.4%	73.2%
Top 8 Firms	96.4%	74.1%	81.2%

* Total includes "other" salmon products

Source: Department of the Environment Unpublished Production Schedules.

TABLE IIb-11 - UTILIZATION OF BRITISH COLUMBIA SALMON
(000 Tonnes)

PERIOD OR YEAR	CANNED	%	OTHER	%
1952 - 1955	52.2	70.2	22.2	29.8
1956 - 1959	45.2	72.9	16.8	27.1
1960 - 1963	41.2	73.6	14.8	26.4
1964 - 1967	44.6	74.1	15.6	25.9
1968	57.2	69.2	25.4	30.8
1969	20.4	54.0	17.4	46.0
1970	46.5	64.1	26.0	35.9
1971	45.5	72.1	17.6	27.9
1972	37.8	39.1	58.9	60.9
1973	50.4	58.2	36.2	41.8
1974	45.9	72.5	17.4	27.5
1975	-	-	-	-
1976	32.9	57.3	24.6	42.7
1977	41.1	62.7	24.5	37.3
1978	35.9	50.8	34.7	49.2

Source: Calculated from statistics published by the Economics and Statistics Section, Fisheries and Oceans Canada, Vancouver, B.C.

TABLE IIb-12 - TRENDS IN REAL WHOLESALE PRICES* OF CANADIAN SALMON BY SPECIES AND PRODUCT TYPE OVER THE PERIOD 1961-76

(annual percentage increase)

PRODUCT TYPE	SPECIES				
	Sockeye	Pink	Chum	Coho	Chinook
Canned	0.8	2.0	2.6	1.8	0.4
Fresh	3.4	3.9	6.2	4.1	4.5
Frozen	3.5	2.7	4.0	3.3	3.7

*Marketed prices of British Columbia salmon processors deflated by the general wholesale price index (1976 prices based on preliminary data).

Source: G. Alex Fraser, "Salmon, Development Prospects to 1985," Unpublished Report, Fisheries and Oceans Canada, Vancouver, Nov., 1978.

Table IIb-13

1976 Average Gross Profit Margins for Selected Products

Canned Products		Frozen Net		Frozen Troll	
Sockeye (¼ lb. tins)	31.1%	Coho	42.7%	Coho	29.1%
Pink (½ lb. tins)	24.9%	Pink	31.9%	Chinook	23.9%
Sockeye (½ lb. tins)	23.6%	Chum	30.5%		
Coho (½ lb. tins)	14.0%	Chinook	28.1%		
AVERAGE	23.4%		33.3%		26.5%

Source: B. C. Select Standing Committee on Agriculture, Industry Survey.

b) Secondary Sector - Footnotes

1 This section draws heavily from a 1978 study by M. Shaffer entitled An Economic Study of the Structure of the British Columbia Salmon Industry.

2 C.W. Clark and G.R. Munro, Fisheries and the Processing Sector: Some Implications for Management Policy, Resources Paper No. 34, UBC, Feb. 1979

3 Actually, for the purposes of this study it is defined as a few major buyers of fish.

4 Ibid Clark and Munro, p.11

5 see Table IIb-1

6 see Table IIb-2

7 For more detail on processor company ownership of boats, see Table IIa-26.

8 see Table IIa-27

9 see Table IIb-8a and IIb-8b

10 U.M.A. and Edwin, Reid and Associates, Competitiveness and Efficiency of the B.C. Processing Industry, 1976.

11 see Table IIb-11

12 see Table IIb-12

c) Marketing Considerations

World production of commercially sold salmon is dominated by a very small number of countries. Only Canada, Japan, Russia and the United States currently report landings of salmon. Canada's [1] share of world production fluctuated between 9.1% and 18.7% between 1974 and 1977 (see Table IIc-1).

The Canadian catch is not distributed uniformly among species. As is shown by Table IIc-1, Canada's share of the catch is largest of the Sockeye, Chinook and Coho species.

The pattern of utilization of Canadian salmon has been changing over the years. As is shown in Table IIc-2, the percentage of production that is carried has declined in relation to other forms such as fresh, frozen or smoked. Table IIc-3 shows the increases that have occurred in the production and export of frozen salmon. An interesting point to note about the world frozen salmon market is brought out in Table IIc-4 which shows that Canada controls a substantial part of that market, in the neighbourhood of 50%.

As is obvious from the above, Canada relies very heavily on the world market to sell her salmon products. Canada exports between 30-50% of her canned production and between 50-90% of her fresh/frozen production. The United Kingdom has traditionally been the largest consumer of Canadian canned salmon, but as can be seen from Table IIc-6 the United Kingdom's consumption has fallen off in the last few years.

In Canadian fresh and frozen salmon, the United States and France have, until recently, been the largest consumers. As can be seen by Table IIc-7, Japan has become the largest consumer of fresh and frozen salmon. The primary reason for this was the extension of the 200-mile economic zones by the United States, Canada and the USSR. The Japanese salmon fleet was then excluded from these waters and forced to purchase salmon on the world market rather than catch their own. Note that the surge of Japanese investment in fish buying and processing facilities is directly related to their attempt to secure an adequate supply of salmon for their domestic market. Canada consumes about half of her canned production and about 20 percent of her fresh-frozen production. The Canadian market is protected by a 7.5% tariff and is dominated by several large firms.

Marketing considerations had an impact in several ways on the management of the Canadian salmon resource. The first of these is that as Canada controls a substantial proportion of the world's production of certain species (see Table IIc-1) any management moves that increase the quantity of these species produced may not necessarily bring increased net revenues. The availability of markets to accept increased quantities of product at acceptable prices is a variable managers must consider when proposing increased yields from the resource.

Secondly, management programs and institutions must be flexible enough to adapt to changing market conditions. The distribution of fish among different products cannot be fixed in the face of changing demand if maximum use of the resource is to be made. The government policy to allocate a traditional share of the catch to each gear type is inflexible, in the short run at least, to changing market conditions. Trollers catch high quality fish for the fresh/frozen market and net fisheries primarily catch supply fish to be canned. Distributing the catch by gear type does not provide marketing flexibility. Also the government's tendency to regulate on an ad hoc,piece meal basis tends to create a myriad of regulations which encumber the industry and prevent rapid responses to changing conditions. An example of the above can be seen with the recent trend in demand towards fresh/frozen product. The provincial government had introduced a regulation prohibiting new processor licenses from being issued for the purpose of limiting foreign ownership. With demand for fresh/frozen products expanding rapidly, this regulation constrained the capacity of producers to adjust to the new market conditions. This regulation has recently been dropped.

A third way in which marketing considerations affect regulatory policy is through quality control. As a substantial portion of Canada's salmon production is exported and salmon is a very fragile commodity, quality is a very important aspect to the industry. A botulism scare in France in 1978 substantially reduced the sale of Canadian salmon to that country.[2] Canada currently restricts the export of sockeye and pink salmon to only those fish that satisfy Canada's number one grade quality standard. This regulation was originally brought in to protect domestic canners from competition from foreign countries who were using British Columbia salmon. Foreign canners cannot buy lower quality fish and ship it out to be canned. This protects the input supply of domestic canners. A side benefit of this quality regulation was that it improved the image of Canadian salmon as a quality product,particularly in the Japanese market.

Finally, the fact that Canadian salmon is sold in many diverse markets would complicate the use of a taxation scheme to rationalize the fishery.[3] A taxation system operates by decreasing the returns from fishing to the fishermen and forcing some fishing effort out of the fishery. The effectiveness of a tax per unit of fish to do that is dependent on the incidence of the tax. As the incidence of the tax is dependent on the market structure and the market structure is likely to be different in each market where salmon is sold, a taxation scheme may be a complicated management tool to use.

Marketing Considerations - Footnotes

1 As Atlantic Canada's salmon fishery has been severely curtailed due to stock shortages, the Canadian salmon fishery is for all intents and purposes the British Columbian salmon fishery.

2 see D.B. McEachern, Annex to the Worldwide Fisheries Marketing Study: Prospects to 1985: Salmon (draft), October 1979, p. 30.

3 The use and operation of taxation systems to manage the fishery will be discussed in detail in the recommendations section of this paper.

Table IIc-1

Canada's Share of World Production

(metric tons, round weight) numbers in () - % of world production

	Pink	Chum	Sockeye	Chinook	Coho	Total
1974	11,207	12,479	21,694	7,637	10,378	63,985
	(11.9)	(10.3)	(41.0)	(31.6)	(24.1)	(18,7)
1975	10,239	5,389	5,681	7,289	7,737	36,335
	(6.0)	(4.2)	(14.7)	(29.4)	(24.2)	(9.1)
1976	17.056	10,922	12,339	7,776	9,322	57,415
	(11.7)	(8.9)	(20.5)	(28.8)	(24.2)	(14.4)
1977	24,723	6,032	17,388	7,522	9,857	65,522
	(11.0)	(5.1)	(27.0)	(28.5)	(31.6)	(14.0)

Source: adapted from McEachern (1979) pg.6

Table IIc-2

Utilization of British Columbia Salmon (000 tonnes)

	Canned	%	Ohter	%
1952-55	52.2	70.9	22.2	29.8
1956-59	45.2	72.9	16.8	27.1
1960-63	41.2	73.6	14.8	26.4
1964-67	44.6	74.1	15.6	25.9
1968	57.2	69.2	25.4	30.8
1969	20.4	54.0	17.4	46.0
1970	46.5	64.1	26.0	35.9
1971	45.5	72.1	17.6	27.9
1972	37.8	39.1	58.9	60.9
1973	50.4	58.2	36.2	41.8
1974	45.9	72.5	17.4	27.5
1975				
1976	32.9	57.3	24.6	42.7
1977	41.1	62.7	24.5	37.3
1978	35.9	50.8	34.7	49.2

Source: McEachern (1979) pg.8

Table IIc-3

Disappearance of Pacific Frozen Salmon (tonnes)

	Production	Exports	Imports	Consumption
1968	16,014	10,143	643	2,951
1969	11,616	12,923	870	1,983
1970	17,218	10,557	1,358	3,966
1971	11,827	13,456	1,630	2,822
1972	21,792	17,589	1,242	1,283
1973	22,366	21,127	1,572	2,487
1974	8,920	14,201	2,211	-
1975	8,737	14,119	1,454	-
1976	14,583	12,380	1,505	3,102
1977	16,640	15,843	3,578	5,588
1978	23,498	22,952	3,650	2,710

Source: McEachern (1979) pg.24

Table IIc-4

World Exports of frozen Salmon (000 Tonnes)

	Canada	World Exports
1967	9.7	13.5
1968	10.1	13.5
1969	12.9	22.3
1970	10.6	18.8
1971	13.5	19.9
1972	17.6	26.0
1973	21.1	40.1
1974	14.2	20.5
1975	14.1	30.9
1976	12.4	26.5

Source: McEachern (1979) pg.18

Table IIc-5

Disappearance of British Columbia Canned Salmon (tonnes)

	Production	Exports	Imports	Domestic Consumption
1968	38,036.6	18,120.9	0	15,792.6
1969	13.589.4	15,970.4	1,419.3	15,094.2
1970	30,991.9	7,018.5	1,730.3	15,173.1
1971	30,568.9	11,002.0	1,476.7	17,635.0
1972	25,533.9	13,486.3	785.6	17,869.4
1973	33,750.1	17,399.5	248.9	16.248.8
1974	31,110.5	12,884.5	98.8	15,404.0
1975	11,264.5	5,736.7	1,714.0	15,849.0
1976	22,335.1	7,346.1	1,989.5	12,203.8
1977	29,200.0	8,287.1	2,650.9	17,389.2
1978	24,535.0	11,415.9	2,830.3	17,147.1

Source: McEachern (1979) pg.23

Table IIc-6

Canadian Canned Salmon Exports By Importing Country (000 Tonnes)

	UK	Japan	Belgium & Luxenbourg
1967	10.6	3.1	2.3
1968	9.7	3.6	1.7
1969	10.5	4.3	1.2
1970	2.8	2.5	0.6
1971	5.8	4.7	1.3
1972	7.1	5.2	1.0
1973	9.8	3.2	1.7
1974	5.5	2.4	1.1
1975	3.7	2.3	1.0
1976	3.9	4.2	1.0
1977	5.3		1.9
1978	4.7		

Table IIc-7

Canadian Frozen Salmon Exports by Importing Country (Metric Tons)

	USA	Japan	France	U.K.	Sweden	Denmark	W.Germany
1976	2,430.0	338.1	3,778	748	1,563.4	793	1,068.5
1977	1,940.0	3,125.0	4,956.5	523	1,538.6	1,054	956.4
1978	1,923.0	9,377.0	5,211.0	902	1,641.0	1,233	1,024.0

Source: McEachern (1979) adapted from Appendix I

APPENDIX III

Regulatory[1] Structure

The federal and provincial governments share jurisdictional authority in regulating the salmon fishery. Jurisdictional authority was laid out in the British North America Act. "The Fisheries Act enacted under it expresses the formal powers of the Federal Government to manage and protect fisheries including adadromous species like salmonids."[2] In areas where jurisdictional authorities overlap, the federal government has, through both formal and informal agreements, assumed the responsibility for the exercise of this authority. Consequently, this section examines federal regulations made under the Fisheries Act.

Jurisdiction in the non-tidal fishery is somewhat ambigious as discussed by G. Alex Fraser in the history section of this report. Fraser describes the situation as follows;

> "As per the 1898 Fisheries Reference and other subsequent legal decisions, Provincial governments in Canada retain a property right in non-tidal fisheries, while the Federal government retains legislative jurisdiction. In practice almost complete responsibility for non-tidal (primarily recreational) fisheries has be delegated by the Federal government. The provinces generally design the regulations for these fisheries, and while they are enacted by the federal parliament, they are for the most part enforced by provincial authorities."

The provincial authority in the fishery is expressed in the British Columbia Fisheries Act and the British Columbia Fish Inspection Act. These Acts outline provincial authority in the licensing and inspection of processing plants and buying stations; licensing fishermen and mediating negotiations between fishermen and processors. Although processor licensing is a provincial authority, the granting of a license is contingent upon the processor meeting federal standards and the actual inspection of plants is shared by both governments.

The complementary interests of both levels of government have increasingly led to joint Federal-Provincial consultation and action. The Salmonid Enhancement Program is the most obvious and successful illustration of federal-provincial co-operation in fisheries management.

The major federal regulations affecting the salmon fishery are summarized below. The purpose is simply to supply the reader with detail on the regulations referred to in other sections of this report. Federal authority over the salmon fishery is in the hands of the Department of Fisheries and Oceans. Three sets of regulations, under the Federal Fisheries act, apply to the salmon fishery. These are the British Columbia Fishery (General) Regulations (1977), the Pacific Fishery Registration and Licensing Regulations. All three sets of regulations have been amended in 1978 and 1979. The section is organized as follows:

A. The Food Fishery

B. The Commercial Fishery

- I. General Regulations
- II. Regulation of the Net Fishery
  - (i) General
  - (ii) Purse Seiners
  - (iii) Gillnetters
- III. Regulation of the Troll Fishery

C. The Sports Fishery

I. General Regulations

II. Regulation of Tidal Waters

III. Regulations of Non-Tidal Waters

A. The Food Fishery

The Indian food fishery is discussed in another section of this report. The actual regulatory provisions affecting the Indian food fishery are sections 29 and 26 (2) of British Columbia Fishery (General) Regulations (1977).

The most important provision, 29 (1) reads:

> Not withstanding anything in these Regulations, an Indian for the purpose of obtaining food for himself and his family may, under special license issued by the Regional Director or a fishery officer, fish by the method, in the waters and during the period set out in the licence.

B. The Commercial Fishery

I. General Regulations

Regulation of the commercial salmon fishery is provided for under the Fishery Act, primarily section 34 of that Act. In addition section 51 (5) and 51 (6) impart to the Minister of Fisheries power to confer licenses with any desired provisions and determine the quantity conferred. The following important regulations have been applied to the salmon fishery:

(a) Area and time closures -- Sections 5 and 25 (1) of the B.C. Fisheries (General Regulations (BCFGR) and sections 15 (1), 15 (2), 19, 20, and 21 close various areas to all commercial fisheries. Provision, 15 (2) states:

> No person shall fish for salmon for commercial purposes with nets or by trolling, or operate, tour or permit to drift any equipment used in such fishing:

(a) within a radius of one-half mile of the mouth of any river, creek or stream designated by fishing boundary signs coloured International Airport Orange; or

(b) within any area off the mouth of any river, creek or stream designated by white fishing boundary signs.

In addition to these general area closures, the regulations provide for additional area and time closures by gear type. An important provision of the B.C. Fisheries (General) Regulations empowers the Minister, through Regional Director or a fishery officer to vary these closures. Section 4 (1) reads:

The regional Director or a fishery officer may vary any closed time or fishing quota fixed by these Regulations.

(b) Licensing of vessels -- Under sections 51 (5) and 51 (6) the Pacific Fishery Registration and Licensing Regulations (1977) provided the mechanism to implement the License Limitation Program. Sections 40 and 41 of The B.C. Fisheries (General) Regulations also deal with the licensing of vessels. Key provisions of the Pacific Fishery Registration and Licensing Regulations (1977) are the following:

(i) Section 10(1) setting out the four categories of licenses -- A, B, C, and D and the conditions of each category. Note that Schedule III sets out landed weights of various species of fish that are equivalent in obtaining a license.

(ii) Section 17 limiting participation in the fishery to vessel assigned on A or B license according to the above criteria or a vessel replacing an A vessel. Section 18 supplements section 17.

(iii) Sections 19 and 20 provide for the non-replacement and retirement, within a ten year period, of B category licenses.

(iv) Section 22 in conjunction with Schedule II define the ton-for-ton replacement rule.

(v) Section 32(1) and Schedule I establish the fee system for Licenses for each license category.

(vi) Section 36(2) provides for the transferability of licenses.

(c) The Indian Fishery -- In recognition of the special rights and needs of Indian fishermen, the Pacific Fishery Registration and Licensing Regulations has several sections dealing with Indian fishermen. For a more complete description of the Indian fishery see the section of this report which describes and analyzes this fishery. Sections 23 and 24 and the special provision of Schedule I set out the license fees for Indian A vessels and conditions on the sale of Indian AI licenses.

(d) Bans on gear types -- Sections 19.1 and 30.1 of the British Columbia Fishery (General) Regulations and Section 2.4 (c) of the Pacific Commercial Salmon Fishery Regulations spell out gear types which are not permitted in the salmon fishery. Section 19.1 says:

No person shall fish by means of

(a) a sunken salmon or cod net

(b) an anchored salmon net

(c) a floating salmon trap net.

(e) Quality standards -- Phase III of the Davis Plan was concerned with upgrading the salmon fleet and improving the quality of the product. Section 13 of the Pacific Fishery Registration and Licensing Regulations pertain to this goal.

(f) Restrictions on exports -- Two sections of the Pacific Commercial Salmon Fishery regulations, 6 and 7, impose conditions on the export of salmon. These provisions are designed to prohibit the landing by Canadian fishermen of fresh salmon in the United States and guard the quality of salmon exported. Section 6 is concerned with preventing landings of sockeye and pink salmon in the United States:

> No person shall export from Canada any sockeye or pink salmon unless it is canned, salted, smoked, cured or frozen and has been inspected in accordance with the Fish Inspection act.

(g) Pollution control -- Several sections of the Fisheries Act are concerned with protecting non-tidal waters supporting salmon. Section 20 deals with the self-financed construction and maintenance of fish-ways by those whose industrial activity impinges on the ability of salmon to migrate to spawning grounds. An illustrative passage 20 (4) says:

> The Minister may authorize the payment of one-half of the expense incurred by such owner or occupier in constructing and maintaining any fishway or canal; and after a fishway or canal that has been duly approved by the Minister has been built at the cost of the owner or occupier of any slide, dam or other obstruction, or after such owner or occupier has paid one-half the cost thereof and such fishway or canal thereafter proves to be ineffective, except as

> provided in subsection (2), the total cost of any change in such fishway or canal or any new fishway or canal required to enable the fish to pass by such slide, dam or other obstruction, shall be paid by Her Majesty.

Section 33 and subsequent amendments control the pollution of salmon waters both tidal and non-tidal. Provisions 33 (1) deals specifically by pollution of tidal waters by vessels while 33 (3) controls the effects of logging activity on salmon streams. The amendment of provision 33 (2) reads as follows:

> Subject to subsection (4), no person shall deposit or permit the deposit of a deleterious substance of any type in water frequented by fish or in any place under any conditions where such deleterious substance or any other deleterious substance that results from the deposit of such deleterious substance may enter any such water.

Fines of up to $5,000 per day can be imposed on violators of these provisions of the Fisheries Act.

II. Regulation of the Net Fishery

(i) General Regulations -- In addition to the above general regulations for the commercial fishery, several regulations apply exclusively to the net fishery. These regulations close certain areas to the net fishery for specified periods, establish weekly closed periods and prohibit the enclosure of bays or inlets with nets. Relevant regulations are 15.1, 19.2, and 23.1 of the British Columbia Fishery (General) Regulations and 12.1, 17.5 and 18.1 of the Pacific Commerical Salmon Fishery Regulations.

The weekly closed periods are established by provision 18.1 of the Pacific Commercial Salmon Fishery Regulations:

18.1 No person shall fish for salmon except by trolling

(a) in District 1, including the Fraser River, from 8:00 hours on Friday of any week to 8:00 hours on the Monday next following; or

(b) in District 2 and District 3, from 18:00 hours on Thursday of any week to 18:00 hours on the Sunday next following.

These provisions were designed to ensure adequate escapement of salmon to the spawning grounds. It is important to remember that the Fisheries Department, as described above, has discretioary power to vary any closed period in the fishery.

(ii) Regulation of Purse Seiners -- Purse seiners are the most tightly regulated gear type. Regulatory provisions are contained in the Pacific Commercial Salmon Fishery Regulations and amendments (Sections 13.1, 14.1, 14.2, 17.1, Schedules I and V, amendment 10 or SOR/78-796). These provisions specify closed periods by area and gear restrictions on purse seine equipment.

(iii) Regulation of Gillnetters -- Gillnetters also have closed areas and gear restrictions. Relevant provisions are contained in 9, 10,11,18.2(a), 18.2(c), 24(a), 24(b), 26 and Schedule VI of the Pacific Commercial Salmon Fishery Regulations and 24 of the British Columbia Fishery (General) Regulations.

To obtain a complete picture of the impact of regulations on purse seiners and gillnetters, it is necessary to have an integrated overview of the general regulations, regulations specific to net fisheries and those that apply exclusively to specific gear-type. It is also necessary to understand on-line management practices of fisheries officers in the field

III. Regulation of the Troll Fishery

Area and time closures are less stringent in the troll fishery than for net operations. For example, the weekly time closures for the net fishery do not apply in the troll fishery. This is one of the factors that explains the existance of combination gear types in the salmon fishery as fishermen seek to circumvent the regulations concerning size limits, gear utilization and time closures for trollers. For specific provisions see sections 16.4, 16.5, 18.2, 18.3, 25.1 and Schedule VII of the Pacific Commercial Salmon Fishery Regulations section 26 of the June 28, 1979 amendments to these regulations, and sections 50.4 (a) and 50.4 (b) of the British Columbia Fishery (General) Regulations.

C. The Sports Fishery

I General

For regulations concerning the sports fishery see sections 49 through 82 of the British Columbia Fishery (General) Regulations. Part III of these regulations deals with sport fishing in tidal waters while Part IV deals with sport fishing in non-tidal waters.

(i) Tidal Water Regulations -- In general, Section 49.3 specifies the minimum size limit for salmon at twelve inches and the maximum catch per day at four. Further provisions make exeptions for certain species (spring) and areas. Gear restrictions are specified in section 50. Closed time and licensing restrictions for specified areas are contained in section 51 while export prohibitions and restrictions are contained in section 52. Sections 53 and 54 and Schedule III deals with licensing of non-resident vessels engaged in tidal water fishing.

(ii) Non-tidal Water Regulations -- Catch and possession limitations by species (spring and coho) are set out in Schedule V, Items 3 and 4. Section 59 limits the fishery to angling and spear fishing while provision 63.1 (b) establishes a minimum size limit of 8 inches and section 64 imposes gear and bait restrictions. Seasonal and area closures for the seven non-tidal sports fishing districts are contained in sections 65 through 80.

Footnotes - APPENDIX III

1 For a description and history of the evaluation of management authority in the fishery see G.Alex Fraser in his report.

2 Fisheries and Environment Canada, The Salmonid Enhancement Program, 1977, P.80.

APPENDIX IV

a) The Native Indian Fishery

Before a discussion of Native Indian participation in the B.C. salmon industry can be meaningful, it is necessary to define the classification "Native Indian." From a legal standpoint a "Native Indian" fisherman is one whose name is on the official "Band List" maintained by the Dept. of Indian Affairs. There are many "non-status" Indians who are not included in this category and do not, therefore, qualify for the special provisions and programs designed for Indians by the Federal Government despite the fact that they have the same background and problems in the fishery as status Indians.

Native Indians have rights to the fisheries that are not shared by non-Indian fishermen. Indians have traditionally used salmon to provide a major source of food. This claim on the salmon resource is accepted as a priority in the sharing of the catch between commercial and non-commercial users. In the commercial fishery Native Indians are again worthy of special considerations because:

(1) Many Indian villages and reserves are heavily dependent upon commercial salmon fishing, especially in the northern part of British Columbia. Changing conditions in the fishery can affect the very survival of a village and consequently have serious social and economic reprecussions.

(2) Native Indians maintain that their Aboriginal Rights imply that; "... they should always be able to participate in the B.C. fisheries unencumbered by license limitations effected for the general non-Indian population."[1]

(3) Native Indians tend to have fewer employment alternatives than non-Indians. Their historical attachment to the fishery and the community in which they live limits their mobility. Although low opportunity incomes are not unique to Indian fishermen, it is a much more general and serious problem than among non-Indian fishermen.

(4) Indians have more restricted access to capital markets than non-Indian fishermen. A primary reason for this is that many Indians live on reserves and lack collateral necessary to obtain loans. An associated problem is that a high proportion of rental vessels (owned by processing companies) are operated by Indian fishermen.

It has been these features of the Indian salmon fishery that have resulted in the singular impact of regulatory programs on Indian fishermen and shaped the design of special programs and provisions applied to Indian fishermen. Before launching into this analysis it is useful to present a brief overview of the Native Indian salmon fishery.

Indian participation in the salmon fishery can be divided into two parts:

1) The food fishery

2) The commercial fishery

1) The Food Fishery

The Indian food fishery is used as a direct source of food by Indians and the fish caught cannot be sold commercially. Between 1965 and 1973 this fishery accounted for between 2.2 and 3.0 million pounds of fish with a value of almost \$4[2] million in 1973. Sockeye salmon catches have accounted for the majority of landings, being about 60% of the total in 1973.[3] The Fraser River accounted for 53% of the Indian food catch in 1973 with the Skeena River making up an additional 19% of the catch.

The Indian food fishery has been regulated since the turn of the century. At present this fishery is regulated under section 29 of the British Columbia Fishery (General) Regulations.

> Section 29(1) reads[4]: "Not withstanding anything in these Regulations, an Indian for the purpose of obtaining food for himself and his family may, under a special license issued by the Regional Director or a fishery officer, fish by the method, in the waters and during the period set out in the license."

Permits issued to an individual or band council can specify the place, method and time of fishing.

A concern of Indians has been that the food fishery has borne an excessive burden from downward intra-seasonal adjustments of the catch through time closures.

2) The Commerical Fishery

In 1976 Native Indians owned or operated 753 salmon fishing vessels representing about 15% of the salmon fleet.[5] This ratio has been relatively constant since the early 1960's although a slightly higher proportion of the fleet was Indian owned or operated in the 1960's than in the 1970's. That is, while the number of Indian vessels declined substantially the total fleet numbers declined by a proportional amount. It appears, however, that the Indian fishery is much more vulnerable in years of poor harvest as indicated by the steep drop in Indian vessels in 1969 and 1971. The primary explanation for this is that in those years fishing companies, owning vessels, rented fewer of them and Indians rented a relatively large proportion of these vessels.

Figures in Table IV-a.3 show the breakdowns of the Indian fleet by ownership status and gear type. These figures indicate that Indians own and operate a much higher proportion of seiners and gillnetters than trollers. In addition, the data shows that while the Indian gillnet and troll fleets have declined substantially since the initiation of the license limitation program, the seine fleet has increased substantially. Finally, the proportion of the Indian fleet owned by processing companies fell appreciably in the early 1970's but has risen slightly since then.

The Indian fishery appears to be more labour intensive than the Pacific fleet in general although no precise data on this is available. This would be consistent with the impression that the opportunity incomes of Indians outside the fishery are lower than is generally the case for Pacific salmon fishermen. Note that Table IV-a.4 shows that the average value of vessels operated by Indian fishermen is considerably lower than for the total fleet. No information is available on the relative efficiencies of Indian and non-Indian operations.

A major problem for Indian fishermen has been the lack of access of Indian fishermen to conventional capital markets. The lack of collateral of Indian fishermen was noted above and it has been asserted that, while Indians may or may not be efficient fishermen, they lack the business and managerial skills of non-Indians.[6] The large propertion of company rental vessels operated by Indians may be attributed to their poor access to capital. In addition, as the fishery has become more and more capital intensive Indians have become increasingly disadvantaged in gaining access to the fishery.

Poor access to capital markets and the high proportion of Indian operated rental vessels had negative consequences for Indians in the late 1960's and early 1970's. The years 1969 and 1971 were poor fishing years especially in northern B.C. A series of company closures and mergers in 1968 and 1969 led to the abandonment of many rental vessels particularly in northern waters. As put by Friedlander, "... the complete abandonment by companies of some villages with a purely rental fleet displaced, at a stroke, all fishermen regardless of competence."[7] In addition, the poor 1971 season led companies, "... to curtail the number of gillnet and seine vessels that they usually rented or chartered."[8] As a result the number of company gillnetters rented to natives declined from 482 in 1968 to 205 in 1971.

Government regulations have exacerbated the negative impact of market forces on Indian participation in the salmon fishery in several ways:

(1) Conservation oriented regualtions that have let to a substitution of capital for time spent fishing have mitigated advantages of Indian fishermen in the salmon fishery.

(2) License limitation has resulted in larger and more sophisticated vessels and high license values. Given the restricted access of Indians to conventional capital markets, this program could be expected to work against Indian fishermen.

(3) The concern over company control of the fishing fleet resulted in a stipulation that companies must reduce the number of their vessels in accordance with the overall reduction in the fleet (through the buy-back program). Many of these displaced vessels were operated by Indians who were consequently involuntarily forced out of the fishery.

(4) The consistent bias of regulations towards trollers operates against the interests of Indian fishermen who are more heavily represented in net operations.

(5) The inspection standards of Phase III of the Davis Plan displaced a relatively large number of Indians - 25 Indian owned boats were displaced in 1973 alone.

With the implementation of the License Limitation Program the government took special steps to redress the bias of the program against Indian fishermen. The Indian Fishermen's Assistance program, adopted in 1967, was perhaps the most significant. The three point program included:[9]

(1) loans and grants to Indian fishermen for vessels or fishing gear;

(2) the opportunity for Indians to take special practical training courses;

(3) the building of shore installations on reserves so that the trend towards centralization could be reversed.

The program was important because it dealt with the crucial problem of Indian access to capital. Possible efficiency mitigating effects of the program were minimized because, to qualify, Indian fishermen had to have good fishing record and a substantial downpayment of between 12% and 20%. The initial program which ran for five years provided grants and loans totalling nearly four million dollars. The program was extended for another five years.

In addition to the Indian Fishermen's Assistance Program several provisions were included in the License Limitation Program related to Indian fishermen. The most important of these were;[10]

(1) The creation of a special AI license category for Indian fishermen. To qualify for an A license vessels had to meet a minimum landings requirement and pay a license fee that was raised substantially in 1969. Because of this many Indian fishermen were forced or opted voluntarily to obtain B licenses. These licenses were to be retired after a ten year period forcing many Indian producers (and other small producers) out of the industry. To prevent this, the special AI license was made available to Indians which required only a ten dollar fee and did not dictate a retirement date.[11] In the first year, 1972, 63 Indian vessels switched from B to AI licenses. It should be noted that both the minimum landings requirement and the fixed levels of fees on licenses can promote inefficiency in the industry. The former may be biased against small efficient producers while the latter will distort vessel sizes.

(2) Before the special AI license category was established for Indians the Department of Fisheries helped Indians retain their A licenses by paying the fee for them.

(3) Indian fishermen applying after the May 31 deadline each year for salmon licenses, under the direction of the Minister, were given special consideration.

(4) Vessels with AI licenses could be retired and replaced by a new vessel under the Indian Fishermen's Assistance Program. If a non-Indian bought the vessel it would retain the A license only if the retroactive license fees were paid.

The special provisions and programs for Indian fishermen seems to have reversed the decline in Indian participation in the fisheries. For example, the number of Indian fishermen rose from about 1400[19] in 1973 to about 1750 in 1976 after many years of continual decline. This is partly attributable to the Indian Fishermen's Assistance Program. In addition, the decline in Indian vessels up to 1973 was reversed. In assessing the success of the program it is difficult to differentiate its affect from the impact of market forces.

An important point that comes from this analysis is that rationalization programs must take care not to penalize small scale producers who may be efficient but do not meet the required minimum of landings or have access to capital.

Table IV-a.1 Sockeye and Total Salmon Quantities and Values landed in Native Indian Food Fishery, 1965-1973

	Sockeye		Total	
	(000's lb.) Quantity	($ 000's) Value	(000's lb.) Quantity	($ 000's) Value
1965	1080	858	2306	1413
1966	1514	1245	2700	1773
1967	1067	813	2220	1346
1968	1359	1005	2663	1631
1969	1404	1179	2440	1756
1970	1582	1367	2802	2087
1971	1732	1512	2841	2131
1972	1392	1371	2599	2103
1973	1795	2610	3031	3779

Source: M.J. Friedlander, Economic Status of Native Indians in the British Columbia Fisheries, 1964-1973, Tech. Report Series PAC/T-76-25, 1975, P.77

Table IV-a.2

The Indian Owned and Indian Operated Fleet, 1968-1976

	1968	1969	1970	1971	1972	1973	1974	1975	1976
Number of Indian Owned and Indian Operated Vessels	1161	917	980	855	860	790	824	952	933
Proportion of Total Fleet owned or operated by Indians (%)	17.5	14.5	15.5	14.4	15.1	14.4	13.5	15.7	14.6
Number of Indian Owned Vessels	570	540	645	600	583	509	518	641	602
Number of Company Owned - Indian Operated Vessels	591	377	335	255	277	281	306	311	331
Proportion of the Indian Fleet Owned by Companies (%)	49	41	34	30	32	36	37	33	35

Source: The Sinclair Report, Vol. I., P.196

Table IV-a.3

Indian Ownership and Operation of Salmon Vessels by Gear Type, 1968-1976

	1968	1969	1970	1971	1972	1973	1974	1975	1976
Seiners:									
Indian Owned	35	39	57	57	70	66	66	70	65
Indian Operated	97	49	54	43	58	54	63	65	65
Total	132	88	111	100	128	120	129	135	130
Gillnetters:									
Indian Owned	324	305	391	345	327	306	272	276	266
Indian Operated	482	328	280	205	216	225	238	240	260
Total	806	633	671	550	543	531	510	516	526
Trollers:									
Indian Owned	204	189	194	197	185	132	148	166	157
Indian Operated	12	0	1	7	2	1	2	2	2
Total	216	189	195	204	187	133	150	168	159

Source. The Sinclair Report, Vol. I, P. 196

Table IV-a.4

Average Vessels Values of Indian and Total Pacific Fleet, 1964-1976

	Indian Operated				Total Fleet			
	1964	1966	1972	1976*	1964	1966	1972	1976
Seiners:								
Single gear	27.8	28.9	39.8	86.5	29.5	31.5	44.9	110.4
Combination	22.4	32.8	42.8	184.1	36.1	56.3	61.0	191.7
Gillnetters:								
Single gear	3.4	3.8	6.2	14.3	4.7	5.1	9.0	21.5
Combination	4.8	5.9	8.9	24.0	7.8	7.9	15.3	35.5
Trollers:								
Single gear	3.1	3.9	7.9	29.3	5.5	8.7	18.4	43.8
Combination	1.9	4.5	4.2	18.0	9.8	12.3	30.0	63.9

Source: The Sinclair Report, Vo. I., P.201

*1976 data should be interpreted with cautiong since Indian operated and total fleet vessel value figures are not comparable for 1976

b) The Sport Fishery

The salmon sport fishery in British Columbia represents a significant and growing use of the salmon resource. Available data indicates that over 500,000[1] salmon were caught by sports fishermen in British Columbia in 1976. This data should be used with a great deal of caution, however, as the Department of Fisheries has little confidence about the reliability of any data in the sports fishery. Referring to the data presented in Table IV-b.1 a 1977 study conducted for the Salmonid Enhancement Program stated, "Unfortunately, staff in the region estimate that these figures are biased downwards by as much as 50%."[2] More recent studies indicate that the actual catch may be three times the reported catch.[3]

The signifigance of the sports fishery has been growing in recent years. The fishery is primarily a salt water activity[4] as the fresh water fishery has been severely restricted and many areas closed entirely due to diminished stocks.[5] It is still significant in northern areas particularly in the Lower Skeena River system. Accordingly, this report focuses primarily on the salt water fishery although, with the Salmonic Enhancement program, it is expected that the fresh water fishery will become more significant.

The importance of the sports fishery varies widely by area and species. Table IV-b.2 shows the landings in various areas of the province. Table IV-b.1 shows that chinook and coho salmon, are by far the most important sport fish. The sport fishery, therefore, competes mainly with the troll fishery (which also concentrates on these species) for a share of the catch. While, in total, sport fish catches are a small percentage of the total catch,[6] it can be a very important factor in certain areas for a given species. For example, in the Strait of Georgia, British Columbia's most important saltwater sport fishing area, sport fishermen are estimated to take 83% of the total coho catch and 65% of the total chinook catch.

The number of participants in the British Columbia sport fishery is strikingly large. In 1976, estimates put this number at 500,000 for the sport fishery overall and 300,000[7] for the tidal water sport fishery. The estimated growth in the number of participants is 5%, about double the provincial population growth rate. About 90% of saltwater fishermen live in the Vancouver Lower Mainland. In addition to the expansion in effort due to a growing number of fishermen, vessels in the fishery have become increasingly mobile and efficient at catching salmon due to improved gear and fishing techniques.

Expenditures by sport fishermen related to the fishery are large. A Department of Fisheries and Oceans study summed up this spending as follows; "During 1976, resident and non-resident anglers spent $100 million on goods and services directly related to pursuit of their sport (e.g. tackle, food and lodging etc.). They spent an additional $225 million on durables such as recreational vehicles and boats which are used in whole or in part for sport fishing."[8] Of the 100 million dollars spent directly on the sports fishery about 30 million dollars was attributable to the salt water salmon fishery.

The sport fishery suffers from the same common property problem as was discussed above for the commercial fishery. The economics of common property resources is not discussed here.[9] The benefits derived from sport fishing and the costs directly attributable to it are more difficult to quantify however. Benefits include not only the act of catching a fish but all of the associated pleasures of participation in the fishery. The relationship of these benefits to the total catch of fish is not clear. While there are direct fishing costs (gear, tackle etc.), there are also indirect costs that are only partly attributable to the fishery (boats, recreational vehicles etc.). Quantification of these benefits and costs is complex due both to conceptual and data problems.[10]

Several important points can be made however. With virtual open access in this fishery most benefits from this use of the resource accrue entirely to the participants. With a large number of participants and with a zero price on the resource itself, the consumption of this form of recreation will proceed beyond the level that is desirable from a societal point of view. As in the commercial fishery the result is economic waste and excess pressure on the stock due to an excess of effort applied by participants. Accordingly, the government as owner and manager of the stock should utilize the same basic tools to correct this situation as were discussed for the commerical fishery. That is, they should charge a price for sports fishermen to catch the fish that reflects the value of that fish to society.

The practical question is what allocation of the fish between commercial and recreational uses is desirable. On purely economic grounds the resource should be allocated between the two uses by distributing it to those users willing and able to pay the highest price for it. As was seen for the commercial sector, however, the added benefits of any management program must be measured against the costs incurred in achieving these benefits. The costs of achieving the maximum benefits from the sports fishery appear to be even higher than for the commercial fishery and an appropriate trade-off must be made. In addition a management program must reflect the non-economic societal objectories and be sensitive with the political environment in which it will operate.

At present the sports fishery in British Columbia is not highly regulated. Open access has prevailed and, in general,[11] no licensing system has been implemented. The tidal fishery has catch and size limits varying by area and gear restriction. The fresh water fishery has these regulations but also area and time closures and is licensed by the province.[12] In addition, the Regional Director of fisheries can establish discretionary closures to ensure escapement. However, while management goals in the commercial fishery since 1969 have been at least partially based on economic considerations such has not been the case for the sport fishery.

The burden of the conservationist regulations in the recreational fisheries is not evenly distributed. The non-tidal fishery is much more highly restricted than the tidal fishery and in many areas has been closed entirely. The commercial fishery with its more restrictive area and time closure regulations and limited entry program is also left relatively worse off due to the regulatory structure and management practices.

It is likely that mandatory licensing will be implemented in the recreational fishery in the near future. This will be a personal yearly licensing scheme with a minimal charge for the license (probably $5). The purpose of this move appears primarily to be to allow for the generation of better information concerning catch andeffort levels in the fishery.[13] The fee associated with the license can also help defray the costs of the Salmonid Enhancement Program.

The proposed personal yearly licensing and fee system is desirable in that it facilitates greater control over the sports fishery and establishes the concept that sports fishermen should pay for the use of the fish resource. Furthermore, the concept of licensing has general acceptance in the industry. "Discussions with organized sport fishermen, representatives of the sport fishing industry and with individual sport fishermen, have extended over several years on the topic of licensing. These discussions have resulted in agreement in principle to saltwater licenses. In addition they have indicated that a simple personal license would be most acceptable and easily understood by anglers."[14] Future increases in fees would allow the government to appropriate more significant revenues from the use of the resource by sports fishermen.

A personal licencing and fee system, however, is not an efficient instrument to attempt to achieve maximum economic benefits from the recreational use of the resource. The criticisms of a vessel licensing fee system in the commercial sector made above apply equally to a personal licensing and fee system for the recreational sector. The information costs of establishing an appropriate fee would, if anything, be even higher than in the commercial sector. The fact that the fee is not directly related to the use of the resource leads to significant efficiency and equity problems as described for the commercial sector.

The most attractive alternative to a system of personal license fees would be an extension of the property rights scheme proposed for the commercial fishery. In theory the optimal scheme from an efficiency point of view would be one that involved the auctionning off of total salmon quota with participants in both fisheries bidding equally for the quotas. Divisibility of quotas would be an important consideration in this plan. The result of the program would be to distribute quotas to those who were willing to pay the top price for them whether they be commercial and recreational fishermen. The economically rational allocation of the resource between the two sectors and within each sector is the attractive feature of this program.

It may, however, be advisable to establish an initial allocation of the total quota between the two sectors based on estimates of the historical landings in each sector. Since the present allocation has no economic or social basis, the initial allocation should be revised appropriately as market information from both sectors emerged over time. The most efficient way to facilitate this redistribution would appear to be to allow transferability of the quotas between the commercial and recreational fisheries.

The distribution of the quota set for the recreational fishery is a complex problem. Ruling out an auction for the quotas, some alternative method of distribution would be required. More research is necessary to establish a program that would allow for an orderly, efficient and equitable market for quota rights in the recreational fishery and the redistribution of rights between the recreational and commercial sectors. The novel character of this program and the many complex issues involved imply that its implementation is probably not immediately possible or advisable. An immediate move should be made, however, to establish the principle that recreational fishermen should have to pay for the right to participate in the fishery. Such a program should, in addition to constraining effort and appropriating rent for the government, be designed to provide information on the value placed on fishing by recreational fishermen. This value could then be compared to the value of quotas in the commercial sector to provide a criteria for the transfer of rights between the two sectors.

Table IV-b.1[1] British Columbia Sport Catch and Effort by Year and Species, 1972-1976 (Numbers caught[2] and weight* in millions of pounds)

Species	1972		1973		1974		1975		1976	
	No.[2]	Weight[3]	No.	Weight*	No.	Weight*	No.	Weight	No.	Weight*
Springs & Jacks	118,207	1.9	116,009	1.9	112,320	1.8	155,306		216,055	2.5
Coho	107,680	.7	119,162	.8	247,315	1.6	163,067	1.1	174,600	1.1
Spring Grilse	35,520	n.a.	32,239	n.a.	36,694		48,685	n.a.	76,345	n.a.
Coho Grilse	48,412	n.a.	57,283	n.a.	65,269		60,383	n.a.	57,603	n.a.
Pinks	5,424	o	25,769	.1	8,827	o	17,756	.1	13,706	.1
Sokeye & Chums	1,866	n.a.	4,508	n.a.	3,440	n.a.	2,296	n.a.	1,239	
Total	317,109		354,970		483,775		447,413		539,548	
Fishing Effort	325,652		350,082		370,522		378,706		391,337	
Boat Days										

1 Source: 1976 Salmon Sport Fishing Catch Statistics, Dept. of Fisheries and the Environment, Table 1, P.10

2*The numbers of fish caught were derived from estimates of field officers with the Department of Fisheries and Oceans. They are believed to be significantly understated as described in this section.

3 Weights were obtained by multiplying the numbers of fish caught by the average weight of a mature fish of each species.

Table IV-b.2 BRITISH COLUMBIA SALMON SPORT CATCH AND EFFORT BY AREA AND SPECIES 1976[2]

(Numbers of Fish)

	SPRINGS & JACKS	COHO	SPRING GRILSE	COHO GRILSE	PINKS	SOCKEYE & CHUMS	TOTAL ALL SPECIES	TOTAL BOAT DAYS	CATCH BOAT DAY
Rivers Inlet-Smith Inlet	2,330	1,066	46	73	920	57	4,492	3,690	1.2
Port Hardy-Alert Bay	3,771	2,504	110	116	5,075	244	11,820	3,902	3.0
Campbell River	12,635	35,360	530	2,875	855	-	52,255	38,612	1.4
Comox-Courtney	33,721	59,267	25,740	24,429	760	62	143,979	88,649	1.6
Powell River	9,470	12,570	1,445	2,200	250	10	25,945	11,340	2.1
Pender Harbour	8,710	10,425	1,250	1,090	-	-	21,475	22,650	.9
Nanaimo	11,940	13,510	10,015	5,700	-	200	41,365	27,097	1.5
Cowichan Bay	18,858	6,934	4,507	921	5	83	31,308	30,308	1.0
Saanich Inlet	24,779	2,562	5,928	5,012	-	-	38,281	28,040	1.4
Victoria-Sooke	51,031	13,438	8,697	4,416	-	-	77,582	53,892	1.4
Port Alberni	9,143	1,097	2,608	709	-	148	13,705	18,825	.7
Vancouver-Howe Sound	17,722	5,703	11,405	700	-	50	35,580	40,141	.9
All Other Areas	11,945	10,164	4,064	9,362	5,841	385	41,761	24,231	1.7
TOTAL	216,055	174,600	76,345	57,603	13,706	1,239	539,548	391,377	1.4

1 Source: 1976 Salmon Sport Fishing Catch Statistics, DFO., 1976

Footnotes - (b) Sport Fishery

1 see Table IV-b.1

2 W.D. Masse and K. Peterson, Evaluatuion of Incremental Recreational from Salmonid Enhancement, March, 1977.

3 W.D. Masse and P.W. Sterne, Review of Licensing and Salmonid Enhancement Program Cost Recovery Mechanishms For the British Columbia Tidal Water Recreational Fishery, Nov. 1977, P.2

4 Estimates indicate the fresh water catch of chinook is about 11% of the total chinook sport catch and the fresh water coho catch is between 9% and 16% of the total catch.

5 It is argued that the fresh water sports fishery and the terminal gillnet fishery bear the brunt of regulations designed for stock conservation. The main reason is that at this point field officers can more easily identify the size of individual stocks and take appropriate action to ensure adequate escapement

6 Again it must be stressed that the unreliability and downward bias of available data may mean that the signifigance of the sport fishery is vastly underestimated.

7 Of this total, about 80,000 or 27% are out-of-province fishermen.

8 W.D. Masse, Recreational Fisheries Problems and Prospects - Development to 1985, Draft

9 see The Genral Analysis of this Report

10 For a methodology used to attempt this see W.D. Masse and K. Peterson, Op.cit., 1977

11 Exeptions are that Non-residents must obtain vessel licenses and there are special areas that require personal licenses.

12 Mandatory licenses are required to participate in the fresh water (non-tidal fishery. Subject to exemptions for children and senior citizens a licens fee of $5 is charged for residents and $15 for non-residents for yearly participation in the fishery. Non-residents can also obtain special three day license for a fee of $6 and must obtain a special $25 license in addition to the regular $15 license in designated areas of the province. Enforcement of federal regulations for non-tidal fisheries is partly carried out by provincial officers.

13 Licenses will provide a better information based to facilitate surveys by government researchers.

14 W.D. Masse, <u>Op.cit</u>., P.5

c) International Considerations

The various species of salmon follow wide ranging migration patterns. Salmon spawned in Canadian waters spend part of their life cycle in American waters and part of it in international waters. The international nature of the resource raises particular problems for management. As the stocks are not unique to a particular nation, a common property problem among nations exists. Each nation has the incentive to intercept the stocks while the stocks are within their jurisdiction. In the absence of international control this incentive creates two major costs in the case of salmon. The first is that the costs of fishing will be higher than need be. As the salmon populations become more concentrated as they get closer to their spawning streams, the salmon are cheaper to catch.

However, if for example, a Coho stock is swimming down the coast of British Columbia towards their spawning streams in Washington and the British Columbian fishermen can catch them at a cost lower than the return that they receive, then the British Columbian fishermen will attempt to catch the fish. This is, of course, true of American fishermen and fishermen fishing in international waters as well. This results in the fish being caught at a greater cost than is necessary.

The second major cost results from the lack of incentive for the country where the spawning stream is located to invest in the stock if the returns from that investment are likely to be intercepted by another nation while the stock is outside the spawning country's jurisdiction. For example, the Salmonid Enhancement Program has as one of its criteria for investing in the enhancement of particular salmon stocks; "... minimization of opportunity for interceptions of stocks by other countries."[1]

Therefore, in the case of salmon, there is a need for international coordination to manage the stock effectively. Beginning during the 1890's there was a whole series of meetings and negotiations between the United States and Canada discussing how the two countries should jointly manage the salmon fishery. These meetings finally resulted in the foramtion of the International Pacific Salmon Fisheries Commission (IPSEC) in 1937. The Commission was set up initially to allocate the catch of sockeye in the Fraser River, Juan de Fuca Strait area, between the two countries. The distribution of catch agreed upon was 50/50 within Commission waters: In 1957, the Commission's mandate was extended to include pink salmon as well as sockeye.

Salmon, especially before the introduction of the 200 mile economic zone, spent the greater part of their life cycle in international waters and were fished by the international fleet, primarily the Japanese. After the Second World War the Americans and the Canadians became very concerned about the size of the Japanese catch. In 1952, under the terms of the International Convention for the High Seas Fisheries of the North Pacific, Japan agreed not to fish for salmon east of 175 degrees W. This prevented the Japanese from harvesting North American salmon stocks.

More recently high seas salmon stocks have been the subject of the Third Law of the Sea Conference. It is widely recognized that the states of origin incur many costs in maintaining the freshwater habitat of the salmon and therefore the Conference drafted a resolution which would disallow high seas fishing for salmon except where this would result in economic dislocation for a state other than the state of origin. While international convention are unenforceable such a trend in thinking would seem to be a positive move from the Canadian point of view.

With the introduction of the 200 mile economic zone and the implementation of salmonid enhancement programs, there has been renewed interest in the problem of salmon interception by both the United States and Canada. There are currently negotiations in progress which will attempt to hammer out an agreement on the interception issue.

Table IV c.1

Interceptions of Salmon (1000's of fish)

Origin of Stock	Intercepting Fishery	Pink	Sockeye	Chums	Coho	Chinook
Canada	Alaska	311	116	24	96	130
Alaska	Canada	204	12	45	75	
Wash., Ore., California	Canada	204	7	37	1322	676
Canada	Wash., Ore., California	1212	1854	126	430	108
Balance in favour of U.S.		1115	1951	68		
Balance in favour of Canada					871	438

Source: U.S. Department of Commerce (1977) pg.15.

Footnotes

1 Fisheries and Environment Canada, The Salmonid Enhancement Program, p.27