THE SHARE SYSTEM AND ITS EFFECTS ON INNOVATION, EMPLOYMENT AND INCOME IN THE BRITISH COLUMBIA SALMON FISHING INDUSTRY 1951 - 1961

by

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Abstract

This thesis has been designed to examine the share system and to study its effects on innovation, employment and income in the British Columbia salmon fishing industry. The approach taken has been that of examining the theoretical basis of the share system and then noting how the system has worked in practice.

The share system has demonstrated some notable advantages over a wage system in its approach in providing an incentive for hard work and in the economizing of materials used. Against these advantages must be weighed the heavy burden of risk which is shifted from the capitalist to labour. Share fishermen are not assured that they will earn any income from a particular fishing trip and may, in fact, be forced to bear part of the losses of those ventures which fail.

The share system creates a rigidity in the free movement of resources within the fishing industry by requiring that the net proceeds from fishing be divided between the crew and the vessel owner in fixed proportions. The allocation to labour of a fixed percentage of all net income results in the entrepreneur requiring a higher rate of return on his investment than would be the case if he were operating in a freely competitive market, thus in theory the share system would inhibit innovation. The entrepreneur requires that his investment pro-

jects have a sufficient return to repay both his capital and interest after paying a share to labour.

The number of licensed fishermen and fishing boats has increased annually since 1951. The opportunity of obtaining a high income which is a feature of the share system is a particular incentive which attracts new recruits into the industry. However, many fishermen fail to remain in the industry due to the low and unstable earnings they experience.

The incomes of British Columbia salmon seine fishermen appear, on the average, to be below those offered in alternative occupations, though there are certainly some very high incomes earned by a few fishermen. The increased employment both of labour and capital can, in the main part, be blamed on the common property feature of sea fisheries. The share system, though playing a part in the total industry, is not the most important variable. A solution to the difficulties that the industry faces can best be sought by changes and adjustments elsewhere.

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Introduction

The British Columbia fishing industry has a diverse and complex character. This diversity can be seen in the heterogeneous background of the various fishermen and in the wide variety of fish that are sought. The composition of the labour force actually engaged in fishing is divided on a racial and ethnic basis with representatives from China, Denmark, England, Finland, Greece, Ireland, Italy, Japan, Norway, Scotland, Sweden, Yugoslavia and, of course, the native Indians. These racial and ethnic groups may also be differentiated according to the wealth and income that their members possess. Some ethnic groups are, however, concentrated in a particular sector of the industry, for example, the native Indian is heavily involved in fishing for salmon. Though there is this diversity within the fishing industry, all fishermen appear to be highly competitive, especially within particular fisheries.

Fishermen as a group appear to have some characteristics which differentiate them, at least to some degree, from other workers in the province. Many fishermen live in relatively isolated settlements along the coast, while others congregate in specific areas on the edge of large industrial centres. At work and at rest, fishermen tend to be in contact solely with one another. This factor has led to a comradeship of almost clannish proportions. It is the feeling of comradeship which is so important for the successful use of the share system. Fishing also has a high degree of instability due to the risk

and uncertainty which are inherent to the industry.

The major species of commercially important fish on the British Columbia coast are the salmon, the halibut and the herring. The salmon is by far the most important in value and, in 1962, represented 66 percent of the total landed value of all fish caught. Halibut and herring accounted for approximately 17 and 10 percent respectively.[1] The actual percentages vary from year to year but their position has been relatively stable within the last five years.

Salmon landings are particularly vulnerable to yearly fluctuations. This is due to the life history or cycle of the salmon. There are five species caught in British Columbia, namely, sockeye, pink, coho, chum and spring. The commercial importance of each species varies and is based on such factors as size, quality and life cycle. The life cycle of the salmon varies depending on the species. It ranges from two and three years respectively for pink and coho to four to six years for spring. Chum and sockeye average three to five year cycles. The most distinctive factor of the salmon, however, is that all salmon species return inland to spawn in the stream where they were born. After spawning, they die and the cycle is complete. Most salmon are captured as they return in their cycle year to spawn.

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1 Canada, Department of Fisheries, British Columbia Catch Statistics, 1962, Ottawa, Queen's Printer, 1963, p.2.

The herring is an important fish in Canada and although its landings fluctuate from year to year, it may account for as much as one-third or one-quarter of total fish tonnage landings. The Pacific herring is particularly important in that it accounts for approximately two-thirds of the herring catch and may, as in 1962, be as much as 3.4 times the weight of the salmon landings. The majority of the landings are from the east and west coast of Vancouver Island. Herring, however, has little value as compared to its weight and though in 1962 halibut landed weighed only one-ninth that of herring, it was much more valuable. Halibut is caught all the way from the Straits of Juan de Fuca to the Aleutian Islands with 90 percent of the catch being north of Vancouver Island.[2]

There are many varieties and species of fish and the techniques used in their capture differ widely. Some techniques are specific to a particular genus of fish, while others are applicable to a wide variety. The major techniques used in British Columbia are the purse seine, gillnet, longline and troll. Salmon are caught commercially by all the above methods except the longline which is used for fishing halibut. Herring, on the other hand, are caught mainly in purse seines. The salmon which is the most valuable specie was caught in 1962 by seiners, gillnetters and trollers; each accounting for 45 percent

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2 British Columbia Catch Statistics, 1962, p. 2.

40.1 percent and 14.9 percent respectively of the total weight of the catch.[3]

In the midst of all this diversity, there appears to be at least one thing that all the above fisheries have in common - the share or lay system. It is applicable to fishing operations involving all the above species of fish and to almost all methods of capture, either implicitly or explicitly. The share system makes the remuneration to labour dependent upon the total catch. The purpose of this thesis is to examine the development of the share system and its consequences on innovation, employment and income in the fishing industry. Chapter I traces the historic development of the share system in theory and in practice from its beginning in early Greek agriculture until the present. The effect of the various share systems utilized in British Columbia and the institutionalized arrangements under which they operate is the subject matter of Chapter II. Chapter III is concerned with the theoretical effects and ramifications of the share system on innovation in the primary fishing industry, while Chapter IV examines the effect of the share system on a number of innovations which have been implemented in recent years. The common property feature of fisheries resources is reviewed in Chapter V. Chapter VI deals with the capital investment which has been allocated to

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3 British Columbia Catch Statistics, 1962, p. 3.

the fishing industry between 1951 and 1961 and with its effectiveness and remuneration. A general examination of the number of fishermen employed in the industry and a study of which branches utilize their services is undertaken in Chapter VII. The following chapter, Chapter VIII, is concerned with the income of fishermen and the impact that the share system has had on their earnings. Chapter IX is the concluding chapter which summarizes the effects of the share system and also gives other possible causes as to the low income that salmon fishermen obtain.

Before proceeding further in this study, it would be worthwhile to note a set of criteria upon which the whole industry might be judged. Such criteria, however, frequently differ from place to place and from person to person. Some standard must be achieved which can be acceptable to all. Economists in striving for such a set of criteria usually accept a group based on "economic efficiency". "Economic efficiency" in terms of the fishing industry is based on the cost per unit of output. Cost can be examined in a variety of ways but let it suffice at the moment to say that the real cost of utilizing a factor in its present use, i.e. the fishing industry, is equal to its opportunity cost or the amount this factor could earn in its best alternative occupation or use. Usually at this point, a normative assumption is made which claims that the value to society of a particular product is equal to the opportunity cost. This, in turn, raises the problem of how to determine the best

method of allocating resources to achieve economic welfare. There is a need for a value judgement as to what constitutes the next best alternative. The answer to such an enquiry may differ within society as a whole, both between groups and between individuals, but it is important that some standard be established. This point of reference or standard of judgment is to be the measuring rod of the whole system and is to be such that it will allow a factual accounting to be taken. Economists have by convention made use of the existing political and social framework and have accepted the present distribution of income as given data when dealing with such general problems. The measure which they have usually chosen as their standard of value has been money.

If the present distribution of income is accepted as a given fact and assumed to be acceptable, then it is left solely to the price system to allocate the various factors of production into those fields which display the greatest demand for them. The assumption is made that people both individually and collectively attempt to maximize their income and that this income can be measured by some monetary counterpart. This assumption of income maximization depends on the acceptance of a society in which individual decisions are assumed to be rational and to represent current valuations of present and future alternatives. The price mechanism acting through the rate of interest is supposed to achieve this latter end.

The price system with profit maximization tends to

bring about an allocation of resources in an economically efficient manner when factors are allocated so that their marginal social benefit equals their marginal social cost. The marginal social cost is equal to the opportunity foregone if the factor is allocated to this use, whereas the marginal social benefit is a measure of the value of the total resultant product from such an allocation. Economic efficiency has been discussed in a static setting; no account has been given for the occurrence of change. This will be discussed later in terms of innovation. Economic efficiency is not a goal in itself but is rather dependent upon the value judgment that society places upon its achievement.

The price system is expected to allocate factors of production to their most efficient use to achieve an optimum degree of economic efficiency. Thus the pricing system by which factors are allocated is of paramount importance to the fishing industry as well as to all other industries. The pricing system affects the organization of the fishing industry and the level of remuneration which fishermen receive. The share system is one of the means through which the pricing system works in the British Columbia fishing industry. It will require further study to understand how the pricing system functions under the arrangements of the share system.

Chapter I

The History of the Share System

Throughout the world, fishermen most frequently receive their remuneration in the form of a share of the total catch. This share may be influenced by a variety of factors, such as, the species, number, weight and value of the fish in the total catch. The actual share arrangements differ from country to country and may be modified according to particular customs and institutionalized factors, but unless a particular fishing industry is highly industrialized, the share system, or its variant, is most likely to be present.

The share or lay system is not unique to the fishing industry. Other industries have somewhat similar arrangements. The métayage or share cropping which is to be found in various segments of the agricultural industry presents some basic similarities to the share or lay system of the fisheries. It was in connection with the share cropping or métayage system that economists first began to examine the causes and consequences of share agreements. It is the writer's opinion that an examination of the views held by various economists as they studied the métayage system will be a useful means of providing a proper understanding of the relationship of the share system found in the fisheries.

Land is leased by the various métayer or sharecroppers under assorted arrangements all of which contain the basic

feature that the landlord or his agent receive a specific proportion of the total yield. This fixed proportion or share is obtained by the landlord in lieu of a fixed money rent. A share arrangement such as this results in a variation of the total receipts that the landlord obtains due to fluctuations in price, quantity and quality of the crop. The métayage system is not new and though Sismondi in his book Nouveaux Principes d'Economie Politique [1819][1] placed its conception in the middle ages, other writers ascribed its birth to a much earlier date.[2]

> In Eastern countries this mode of occupying land has existed from the earliest period, and it also prevailed in ancient Italy.... Early Roman farmers were, in fact, métayers.[3]

In early times, the Roman métayer received only a small percentage of the crop yielded by the land. Cato[4] sugested, however, that this small percentage would be increased as the quality of the soil to be farmed declined. Cato also related that though the share received by the métayers was small, it was equitable

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1 J.C.L. Simonde de Sismondi, Nouveaux Principes d'Economie Politique, 2 vols. Paris, 1827, Vol. 1, pp. 192-94, cited in J.R. McCulloch, Treatises and Essays, 2nd rev. ed., Edinburgh 1859, p. 182.

2 McCulloch, Treatises and Essays, pp. 186-88. See also, Richard Jones, An Essay on the Distribution of Wealth, [1831], New York, Kelly and Millman, 1956, pp. 73-98.

3 McCulloch, op. cit., p. 186.

4 Cato the Elder, 234-149 B.C. His only surviving literary work is Derre rustica (On Farming). It is a valuable source of knowledge on the Roman domestic and rural life of this period. "Cato the Elder", The Columbia Encyclopedia, 1942, Vol. 1, p. 315.

as the métayers were not required to supply either their own seed or implements; these were furnished to them by the landlord when he provided the land and livestock.

As time passed, the share system continued to increase in importance, so much so that in later years of the Roman Republic, it became the most prevalent form of land tenure. Not all people, however, greeted this situation with enthusiasm. The farms expanded both in their size and their utilization of capital and yet they failed to experience increased yields. In fact, the decreasing productivity of farms operated under share cropping arrangements led to critical comments by at least one author during this period. Columella [5] asserted that the decrease in farm yields was not due to a decline in the fertility of the soil but was rather a consequence of the inherent weakness of the share system. The weakness of the share system, he contended, was in its failure to provide sufficient incentive to pursuade the share croppers or "coloni partiarii" to exert themselves.

It is interesting to note that later economists continued to remark upon this same phenomenon. François Quesnay's description of French agriculture written in 1756 bore, in some places, a striking resemblance to the report by Columella on

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5 Lucius Junius Moderatus Columella was the author of one of the principle ancient Latin works on agriculture. He lived during the first century A.D. and he wrote De re rustica. "Columella", The Columbia Encyclopedia, p. 398.

Roman methods of cultivation written almost 1700 years before. Quesnay, a leader of the Physiocrats, gave a vivid account in which he stressed the share system's inefficiency and failure to stimulate the métayers to hard work. It was Quesnay's view that any system which provided land and equipment to the métayers under a share arrangement would lead to abuses. Quesnay charged that the métayer often exploited the landlord's oxen by utilizing them in the carrying or cartage trade for the métayer's own personal gain rather than utilizing them in the ploughing of the landlord's fields as he had intended.[6] The share system provided a definite incentive for such practices as the metayer received only a percentage of the crop when he farmed, while if he were engaged in the carrying trade, he obtained the total reward and was not required to compensate the landlord. Quesnay also strongly criticized the continual use by the métayer of oxen rather than horses. It was his view that horses were more suitable and more efficient beasts for the production of agricultural crops than were oxen, and yet farms operating under the share system failed to utilize horses. This failure was due to the poverty of the métayer, a fact which Quesnay blamed on the share system.

Other authors later dealt with the same problem and reached similar conclusions. Adam Smith remarked that it was never in the tenant's interest to employ his own capital unless

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6 François Quesnay et la Physiocratie, 2 vols., Paris, Institut National d'Etudes Demographiques, 1958, Vol. 2, p. 431.

the tenant would be able to recover it with a profit before the expiration of his lease.[7] Smith's further contribution was, however, relatively small. Arthur Young, on the other hand, discussed the métayage system in detail and remarked on the varying conditions under which the system was operated in different provinces of France.[8] Some large land owners let their land to men of substance for money rents and the latter hired them out to métayers. These owners of large estates thus escaped from the inherent risks of farming which were then borne in turn by the renters. Young noted that the métayage system was a great disadvantage to the landlords who rented directly to the métayer as they were forced to undertake risks which they could have avoided or shifted to others under other tenure systems. The landlords, Young claimed as did Quesnay, were frequently abused as the métayers had little incentive to care for the landlords' land and animals with diligence. The landlords under the métayage system received low rents as the land was miserably cultivated. Young did not sympathized solely with the land holding class but also saw the "lowest state of poverty and ... misery" to which tenants were reduced. He commented that in some regions the métayers had become almost

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7 Adam Smith, The Wealth of Nations, [1776], ed. Edwin Cannan, New York, The Modern Library, 1937, pp. 367-368. See also p. 783.

8 Arthur Young, Travels in France During the Years 1787, 1788 and 1789, ed. Constantia Maxwell, Cambridge University Press, 1929.

menial servants due to the high debts under which they had fallen. Young condemned métayage as "... a miserable system that perpetuates poverty and excludes instruction." [9] He attributed many of the ills of French agriculture directly to the system's failure to provide incentive. As a remedy for métayage Young suggested that a long lease of twenty-one years should be provided both for farm stock and for lands with the payments being made in money and not in kind.[10] Young's solution was to be a forerunner of many that were to be recommended in later discussions of agricultural problems, and his writings were to form the basic source of evidence for many of later English authors who dealt with the métayage system.

Strange as it may seem, these earlier authors did not appear to have significantly influenced either David Ricardo or Thomas Malthus who, though dealing with agricultural rent, failed to examine the métayage or share-cropping system. This omission from the literature was readily rectified by the work of Richard Jones in An Essay on the Distribution of Wealth published in 1831. Richard Jones criticized the métayage system as having "... some very serious inconveniences peculiar to itself." [11]

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9 Arthur Young, Travels in France, ed. M. Bentham-Edwards, 2nd ed., London, 1889, p. 18.

10 Arthur Young, Travels in France During the Years 1787, 1788 and 1789, ed. Constantia Maxwell, p. xxx.

11 Jones, Essays on the Distribution of Wealth, p. 102.

One disadvantage that he attributed to it was that "... the divided interest which exists in the produce of cultivation, mars almost every attempt at improvement." [12] A second disadvantage was that "... when a stock is to be advanced by one party, and used by another for their common benefit, some waste and carelessness in the receiving party, great jealousy and reluctance in the contributing party follow naturally." [13] While a third disadvantage is seen in the fact that the métayage system required the proprietor's constant attention and management. [14]

J.R. McCulloch in his Principles of Political Economy [1825] contributed little new to the discuasion but instead echoed the sentiments of Adam Smith. Throughout this and other works, he stressed the abject poverty to which the cultivators were reduced by the métayage system and also suggested that a métayer would "... scrupulously abstain from laying out anything on improvements, unless they happen to be such as promise an almost immediate return." [15] McCulloch, in his Treatises and Essays, however, dealt more specifically with the letting and occupancy of land as he reviewed the contributions of earlier authors.

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12 Loc. cit.

13 Ibid., p. 103.

14 Ibid., p. 104.

15 J.R. McCulloch, Principles of Political Economy, 2nd ed., London, William Pickering, 1936, p. 511.

All economists, however, did not think that the share system was bad. A French landowner and economist, Simonde de Sismondi, favoured the system. His description and comments were diametrically opposite to those of Arthur Young. Sismondi believed that

> ... cultivation by métayers, or occupiers paying half the produce, is one of the happiest inventions of the middle ages; that it contributes powerfully to diffuse happiness amongst the lower classes, to carry the soil to the highest pitch of cultivation, and to accumulate the greatest amount of capital upon it. [16]

Sismondi also ascribed a security to the tenure of the métayer and though admitting that legally the metayer might be removed at the end of each year, he asserted that there was a customary security.

John Stuart Mill was another economist to see merits in the métayage system,[17] though he was well aware of the previously mentioned literature opposing it. Mill recognized the importance of the point made by Adam Smith but was of the opinion that the defects pointed out particularly by Arthur Young were due to imperfection in the system and would not be applicable to a system that was operating perfectly. Mill disputed the claims of Young, Jones and McCulloch and suggested that the criticisms they levied were based on the insecurity of tenure and

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16 Simonde de Sismondi, Nouveaux Principes d'Economie Politique, Vol. 1, cited by McCulloch, Treatises and Essays, p. 182.

17 J.S. Mill, Principles of Political Economy, [1848], New ed., ed. W.J. Ashley, London, 1909, pp. 302-323.

that their criticism would no longer be valid if tenure were secure. Mill based his argument on two sources of evidence from two countries. He claimed that Sismondi's comments [18] on varying regions in Italy supported him and that evidence could also be found in Ireland in the role of the Irish cottier. Mill asserted that the faults to be found at the root of the métayage system were its competitive rents and its failure to provide security; if security of tenure were assured, almost all problems would be removed. [19] Mill made an important contribution to the understanding of the effects of the métayage system when he commented that it was the "... multiplication of people beyond the number that can be properly supported" [20] which was the cause of misery and poverty.

J.S. Mill's contribution, though worthwhile, fades in significance when contrasted with the clear and concise exposition of Alfred Marshall. [21] Marshall presented a tidy analytical model that gave great insight into the actual institutional framework of the share system. He explained in his usual diagrammatic form the relationship of the share system to the intensity of cultivation that is practised by the sharecropper.

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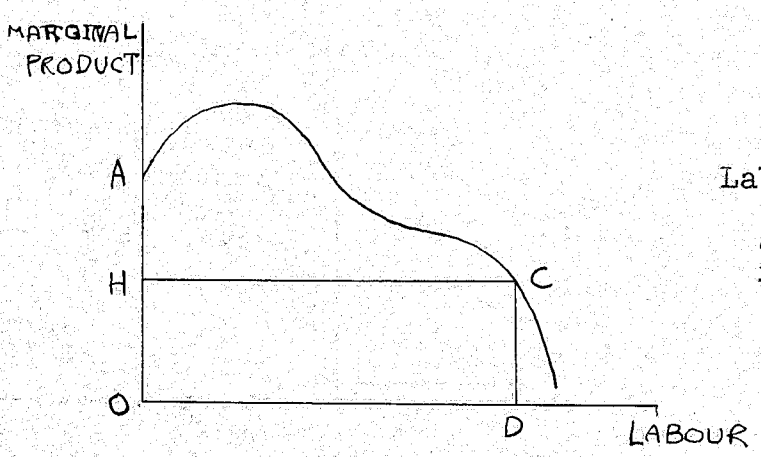
18 J.C.L. Simonde de Sismondi, Etudes sur l'Economie Politique, 2 vols., Paris, 1837, Vol. 1, pp. 286-293.

19 Mill, Principles of Political Economy, p. 320, See also, pp. 302-23.

20 Ibid., p. 304.

21 Alfred Marshall, Principles of Economics, [1890], 8th ed., London, Macmillan, 1920.

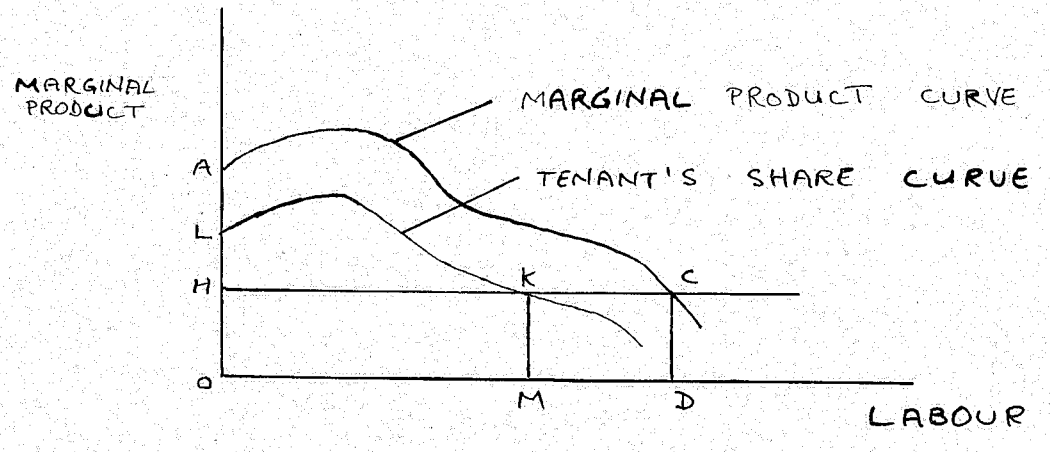
Marshall dealt with a specific area of land and applied an increasing number of equal doses or increments of capital and labour; this, he suggested would result in a diminishing rate of return from the land. He assumed that diminishing returns were present on the intensive margin, for without diminishing returns, all products could be obtained from a single piece of land and no incentive would be given to utilize other land. This proposition does appear to be reasonable in the light of actual physical facts, for it is diminishing returns which explains the limit of cultivation on the intensive margin and the need to exploit the extensive margin. Marshall, with diminishing returns explaining the degree of cultivation, asserted that whatever the cultivator obtains from all his doses of capital and labour minus the cost of the marginal dose times the total number of doses applied can be viewed as a surplus of the land or as a producer's surplus. Marshall explained this diagrammatically as follows:[22]



Labour represents a composite dose of labour and capital as they are applied to a fixed quantity of land.

22 Marshall, Principles of Economics, pp. 155n - 156n.

The gross product can be represented as ACDO. CD represents the amount required to remunerate the cultivator for his last unit of labour and is equal to OH as HC is constructed parallel to OD. The amount OHDC is that actually required to remunerate the cultivator in order that he produces this quantity of product. AHC is the amount over and above the required share and is the surplus product which, under specific conditions, constitutes rent. No matter what tenure system is used, the rent will be the same if all factors are receiving their full marginal product. The share system has a particular effect which makes its results different from that which would be found under a system that utilizes a fixed payment for the land. If the share system is in effect it is not the total product ie, the area under the marginal product curve which is relevant, instead it is the tenants' share curve which must be considered. The tenants' share curve is based on a percentage share of the total product and is identical to the marginal product curve but set at a lower level. Marshall demonstrated this as follows.[23]



23 Marshall, Principles, p. 644.

The marginal product curve remains the same as before, i.e. AC, but the tenants' share curve is a fixed percentage of the total product curve both rising and falling with the latter. The curve LK represents the tenants' share curve. The area below the curve LK represents the tenants' share, that above and between AC represents the landlord's share. If the tenant is left alone and without supervision, he will only apply himself until the point K is reached, that is, until the marginal return is equal to the marginal cost to him of his labour. The landlord will enjoy a smaller proportion than if he had insisted on a fixed rent, and furthermore, he will have a smaller proportion of a <u>smaller</u> total product than would have occurred under a fixed rent system. Here, then, from the landlord's point of view, is the diagrammatic proof of the weakness of the share system as it is applied to the distribution of Ricardian rent.

Chapter II

The Share System and Organization of the Fishing Industry in British Columbia

The share system as operated in the fisheries is basically similar to that used in agriculture and as described in the previous chapter. However, it will be necessary to give a brief summary of how in general the system works at present. In most fisheries, the arrangement is based on the sharing of the total catch with the actual division depending either on the weight or the value of the landings. Historically the net stock is divided between the crew and the vessel. The boat's share is understood to pay for depreciation, interest, taxes and profit, whereas the crew's share constitutes the remuneration to labour. The most significant fact of most share arrangements is the deductions which are made from the gross proceeds or grosscstock before the final share division takes place. The arrangement of these deductions which covers such things as the running cost, that is, fuel, ice, water and food, and also such costs as those incurred due to a loss of gear and selling of the catch. These actual deductions are not always applicable to all fisheries and depend upon the institutionalized arrangements. If the boat is small and is operated by a small crew, the formal share system may not be operative. It is mainly on the larger boats, both individually and company owned, that the share system is found.

The share system is readily applicable to the fishing industry and contains many attributes of a similar nature to those previously discussed in relation to agriculture. The fishing

industry possesses major reasons for having a share system similar to that of agriculture, namely in relation to risk and incentive.

The share system can be examined in terms of its relationships to (a) the vessel owner, and (b) the crew member. To the vessel owner, the share system reduces the burden of a high overhead which he would be forced to carry if the crew were paid by wages. This reduction of overhead is particularly important to a single vessel or to a small group of vessels. Fishing is by nature a risky enterprise and variations in catch readily occur from trip to trip. A heavy overhead or a high fixed wage bill might force the smaller owners into bankruptcy if they were unfortunate enough to partake in a number of unlucky trips. This worthwhile effect of the share system in reducing risks is not so important if the vessels are larger and therefore the labour costs are a smaller proportion of the total cost. Such vessels also have the added advantage of being able to undertake longer and more varied trips. In certain cases, the share settlements are not made immediately upon the completion of a single trip but, in fact, encompass a number of voyages. This delayed settlement has a double advantage to the vessel owner as he will have a lower rate of turnover among his crew if they are forced to wait for their pay and the vessel owner will also have reduced the risk he would have had to bear by averaging his labour costs over a number of trips. Delayed settlement is not usual. The total value of the catch may fluctuate due to

price instability in the short run and this risk may also be combatted by share contracts.

The share system also benefits the ship owner by creating an incentive for the crew to work harder. The belief that the share system creates an incentive for hard work was also found as a basis for the share system in agriculture; however, in the case of fishing, the high risk factor which the crew men bear appear to be larger than that borne by the average farmer. The high inherent risk found in fishing is sufficient to require remuneration in the form of shares. The effect of the share system on incentive only further emphasizes this need. Incentive is given to a fisherman to ensure careful handling and the maintenance of high quality of product for if they fail to do so they will suffer a loss. The fishermen will also economize on their use of supplies, fuel, water and ice, if they are forced to bear part of the costs.

The crew also obtains some real advantages from the share system. Trade unions favour it since it guarantees that labour shares in increased vessel productivity and permits access to figures of cost and profit of fishing ventures which enables unions to bargain more favourably. The crew must also certainly be affected by the incentive of possibly obtaining higher earnings than they could make under a wage rate system. In the short-run, the crew is forced to bear risks which would, under another system, be borne by the vessel owner. It is usually assumed that in the long-run, fishermen's earnings would be higher due to their

assumption of this risk. This assumption, however, is based on the view that fishermen are averse to risk bearing and that they require a monetary reward to persuade them to assume risk. If, however, fishermen possess by nature gambling instincts, they may not be averse to the assumption of risks. I. Bowen [1] feels that fishermen possess a gambling preference which can be characterized as being based on the psychology of a 'big pay packet'.

The major value of the share system to the crew is that it allows for the reduction of supervisory personnel. Under the share system, each crew man bears some responsibility for the total costs of the trip and therefore each person supervises the other. An efficient operation with a reduced crew leads to higher rewards for those fishing. There is a definite incentive created for the share system

This view of incentive appears at first glance to be somewhat inconsistent with that described by earlier authors as applicable to farming. These earlier authors, especially Quesnay, had asserted that the sharecropper would find it to his advantage to utilize the landlord's equipments in uses from which he is not required to return a share. This divergence of views

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1 I. Bowen, discussion of "Fishermen's Remuneration", paper presented by H. Zoeteweij to a Round Table organized by the International Economic Associationm Rome, September 1956, in R. Turvey and J. Wiseman, eds., The Economics of Fisheries, Rome, Food and Agriculture Organization of the United Nations, 1957, p. 35.

may possibly be explained by the fact that in fishing ventures the opportunities for such misuse are not as readily available. There are a number of individuals concerned and as each crew man shares in the total gain, he has an incentive to check the waste of his fellow workers. The sharecropper in agriculture, on the other hand, tends to work as an individual and therefore does not have to share the labour remuneration with other workers. The fact that the vessel owner or one of his representatives frequently works alongside the crew as an equal partner also limits the possible abuses. The individual crewman still has the incentive to utilize equipment where possible for his own individual benefit and it is only the supervision of fellow workers and the highly specialized nature of the equipment which keeps this in check. At least one author, Bowen, has suggested that the closeknit nature of fishing as an occupation presents particular sociological factors which encourage the use of shares and that the share system through its incentive provides ready means of disciplining fishermen who, in other circumstances, would require great supervision.[2]

There are at least six possible variables which determine the net share that the individual crewman receives: (1) the quantity of the catch; (2) the size of the operating expenses; (3) the price received per unit of catch; (4) the proportion of

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2 Loc. cit.

these expenses "above the line" and "below the line"; (5) the ratio of the fisherman's share to the "net stock"; and (6) the number of fishermen on the crew.[3]

For individual boats but not for the total fleet, variables (1) and (2) are on the average directly related to the degree of effort exerted in fishing. Variable (3), on the other hand, from the view of the entire fleet and not the individual boats, is inversely related to the quantity landed. In British Columbia, for salmon and herring at least, the last four variables are known in advance due to prior agreement before the vessel sets out to fish. Under the present British Columbia salmon agreements the only variables which are allowed to operate are the quantity of fish caught and the operating costs of catching them. This agreement differs from other fisheries, notably halibut, which is price-determined by an auction. Variable (4) may need some further explanation. In fishing ventures the "gross stock" consists of the value of the catch, and from this value the expenses for operating the vessel must be deducted. Some of these operating expenses fall into the category of those "above the line", that is, they are deducted from the "gross stock" before the share division is applied. Other operating expenses are changed directly to either the crew's share or to the boat's. "Above the line" expenses for salmon seine vessels

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3 Donald White, New England Fisheries, Cambridge, Harvard University Press, 1954, p. 59.

are expenses due to such things as such as fuel and lubricating oil while a "below the line" expense consists of the cost of all provisions which is deducted solely from the crew's share. Variable (5) is determined by union bargaining and variable (6) is set by the captain of the vessel.

The share system gives some security to an industry that is beset by uncertainty. The fisherman becomes a partner in a co-operative venture with the vessel owner as both assume part of the risks. Fishing voyages constitute a joint venture and the share per crewman is determined after every period at sea. When a crew member quits before the end of a season, he is entitled to his proportionate share of the catch. This short period for settlement has a tendency to encourage a turnover among crew members and may, in part, account for the increase during the last ten years in the number of licensees who earn so little income from fishing. Though fishing appears to be a co-operative venture, since April 1, 1957 fishermen have been classified as employees as far as the Unemployment Insurance Act is concerned, thereby allowing them to obtain Unemployment Insurance Benefits. [4] The application of the Unemployment Insurance Act to the fishing industry was in direct opposition to the advice of the Unemployment Insurance Commission which had recommended as early as 1951 that the fishing industry should not be

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4 Canada, Report of the Committee of Inquiry into the Unemployment Insurance Act, Ottawa, Queen's Printer, 1962, p. 75. Note also, pp. 174-180.

covered.[5] Unemployment insurance has been treated by some fishermen as a further source of income and may have acted as an incentive in encouraging them to go fishing. The Income Tax Act also presents some incentive, in that commercial fishermen, like farmers, are allowed to average their incomes over a five year period for income tax purposes. This averaging provision enables them to shift part of the risk and uncertainty that is inherent to their occupations onto the country as a whole.

Having examined the theoretical bases of share agreements for fishing in general, it is necessary to examine the developments that have taken place on the Pacific coast of North America. Share agreements are applicable to all major fisheries.

To catch fish successfully as a commercial venture there is a need for labour, boat and gear. If a single person owns his own boat and gear, then there is no need for a share system as long as he fishes alone. A fisherman in such circumstances pays all his necessary costs including depreciation and the return on his investment and keeps the remainder as remuneration for his labour. Many fishermen do not have their own boat or gear and, therefore, they must either (a) borrow money to purchase a boat and gear, or (b) they must rent a boat and gear from someone else, or (c) they may combine the above by buying the boat and renting the net or vece versa.

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5 Canada, Survey of the Fishing Industry in Canada, Ottawa, Coverage Division of the Insurance Branch, Unemployment Insurance Commission, 1951, p. 82.

If money is borrowed, it bears interest which must be paid as must be the rental on gear. The high risk involved in fishing suggested the advantages of the share system for meeting such payments. This system is not frequent with one-man fishing ventures but when larger vessels are concerned the share system is customary.

Various arrangements are common in the different fisheries of British Columbia. In herring seining the fishing companies to whom the fish are ultimately sold usually provides both the net and boat. The crew receives a fixed price for each ton of herring and the total earnings from this is then divided among the crew members. Fishing companies through the reduced price which they pay per ton of herring retain sufficient money to meet the boat's and the gear's share. The herring fishermen under conditions such as these are on a basis similar to piece-work rates in other industries. The major difference being that under piece-work arrangements individual earnings are based on individual production rather than being based on a share of the total catch of a group of fishermen, as is the case in herring fishing. A system such as the above is possible as most of the nets and many of the vessels are owned by the few companies processing herring, though there are a few individual operators that own both. The vessels that they do not own they charter from their owners at fixed rates per day or by the season.

The halibut fishery provides for a slightly different system of payment with the boat share being 20 percent of the

gross stock before any other costs are deducted. Gear is paid for by replacement out of the crew's share as are all other operating expenses. The fishermen share the remaining proceeds from the gross stock after all deductions.

The most important share agreement, however, is that employed on salmon purse seine vessels. This is the share agreement which will be dealt with almost exclusively for the remainder of the thesis. It serves as a good example of the operations of all share systems. The earliest salmon agreements recorded indicated that the share basis was one-third to the boat and gear and two-thirds to the crew. This system which was common to all salmon seining on the Pacific coast was altered in 1931 from 4 shares to the owner and 8 shares to the crew to the new bases of 5 and 7 shares respectively. Thus from 1931 on until the present agreement was signed in July 1941, the vessel owner received 41.66 percent of the proceeds. The present agreement which was signed as the result of a month-long strike now consists of 4/11ths for the boat and gear, and 7/11ths for the crew. This arrangement has been stable though attempts were made in 1952, upon the introduction of the drum seine, to increase the owner's share of the proceeds. The drum seine method of fishing is competitive with the table seine, though the latter is still in use. The introduction of the power block also brought forward requests by owners for a change in the agreements. The owners requested special rental fees to cover the cost of this new equipment but they were unsuccessful in

overcoming union objections.[6]

The salmon seine sharing agreement as it is presently constituted is operative in the following manner.[7] The gross stock, i.e., the value of the total catch is divided among the boat and gear, and the crew, in the 4/11ths and 7/11ths shares respectively, after the cost of fuel and lubricating oil has been deducted from the gross stock. Both owners and crew are also responsible for meeting specific expenses from their respective shares. The owner is responsible for providing all gear and the crew is responsible for its own provisions (food and necessary clothing).

The organizations that have existed in British Columbia among the fishermen until 1945 were best described as being rather unstable. Gladstone and Jamieson discussed the wide variety of organizations which came into being during a period covering the last seventy years.[8] The desire of fishermen for higher income and greater security in prices had stimulated the growth of British Columbia fishing unionism, but until 1945, no union appears to have been sufficiently strong to survive as

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6 For a historical account of the various shareaagreements noted above, see W. Rigby, Statement to Conciliation Board on Drum-Seine Share Dispute, United Fishermen and Allied Workers' Union, 1954.

7 See Supplementary Agreement for Salmon Seine Vessels Share Basis and Fishing Conditions, June 26, 1961. Reproduced in Appendix 1.

8 P. Gladstone and S. Jamieson, "Unionism in the Fishing Industry of British Columbia", Canadian Journal of Economics and Political Science, XVI, February 1950, pp. 1-11, and XVI, May 1950 pp. 146-71.

a large and efficient organization. These earlier union negotiations and agreements had dealt with the minimum price for fish and with the working conditions of workers afloat and ashore.

The most important such union is the UUnited Fishermen Fishermen and Allied Workers Union created in 1945 as the result of the merging of three former organizations. Today it is the strongest union in the industry. The union membership is open to all persons engaged in the fishing industry except those employing two or more other persons. The total membership has fluctuated, but in 1958, the total was 6,821 members of whom 5,302 were paid up, i.e. 1519 or 22 percent were in arrears with their dues in 1958.[9] During this same year, there were 14,266 licensees engaged in fishing in British Columbia. The United Fishermen and Allied Workers Union, in conjunction with the Native Brotherhood of British Columbia, conducts negotiations on behalf of the fishermen for minimum salmon prices, the share arrangements and working conditions on vessels. The strike weapon is very potent since the union encompasses workers in all segments of the industry, fishing, fish tendering and fish processing. The Native Brotherhood, which is composed almost entirely of native Indians, had a membership of 3,300 in 1958,[10] and of which half were engaged as salmon fishermen, mainly in

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9 Sol. Sinclair, License Limitation - British Columbia, Ottawa, Department of Fisheries of Canada, 1960, p. 115.

10 Ibid., p. 117.

northern British Columbia. There are other fishermen's organizations in existence along the coast, but their importance is limited and they do not partake in price negotiations.

The above two organizations bargain with the fish buyers and processors and also with the vessel owners. The major processing companies are represented by the Fisheries Association of British Columbia which conducts their negotiations for salmon prices and the wages and working conditions of shoreworkers. The vessel owners are organized into two groups, the large and more important being the Fishing Vessel Owners' Association of British Columbia. The rules of this organization limit membership to vessel owners or part-owners with boats having crews of three men or more plus the skipper. This results in the Fishing Vessel Owners' Association being confined mainly to seine and combination vessels. Fish processing companies are excluded from the Association. The Union bargains with the Fishing Vessel Owners Association over the share agreements but the latter works in conjunction with the Union in attempting to settle salmon prices with the processors. The Vessel Owners' Association also negotiates charter rates under which vessels are chartered to the processing companies. In summary, the bargaining arrangements are rather complicated due to the interrelationships of bargaining procedure among the three major parties. No other industry with similar circumstances comes readily to mind.

The bargaining procedure under such conditions as the

above has mixed consequences, it leads to a common objective of catching as many salmon as are allowed by the regulatory authorities, but it also leads to conflict as to how the remuneration is to be divided. The Union negotiates minimum prices for salmon and has a strong bargaining position. The number of strikes that have occurred in the British Columbia fishing industry is extremely high.[11] Since 1952, there has been a strike or a work curtailment due to contract disputes in every year except 1955 and 1956 in at least one segment of the fishing industry. The 1959 strike of salmon fishermen lasted from July 25 to August 9. This was at the height of the season and cost both the industry and fishermen dearly. In 1956 and 1957, this two week period produced the following percentages of the annual catch.[12]

	Sockeye	Pink	Chum	Coho	Steelhead
1956	27%	23%	9%	11%	9%
1957	34%	29%	12%	17%	9%

The 1959 contract agreements reached at the conclusion of the strike substantially increased salmon prices, at least at the level of the minimum contract price. The trend of salmon prices has been upward since 1951 though there was some setback

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11 Gladstone and Jamieson, "Unionism in Fishing Industry", pp. 150-151.

12 British Columbia Catch Statistics, 1959, p. 5.

in 1953 and 1954. 1962 prices are the highest on record for all salmon species. The following table gives the minimum prices paid for the various kinds of salmon since 1951. The two minimum prices for chum are due to a price differential depending on the area where the fish are caught.

Table 1

Minimum Contractual Prices to Fishermen for Gillnet and Seine Caught Salmon at Opening of Season, 1951-1961
(in cents per pound)

Year	Chum	Coho and Red Spring	Pink	Sockeye
1951	7 1/2	18	9 1/2	25
1952	5 1/2 - 8	13	7 1/2	25
1953	5 1/2 - 8	11	7 1/4	22
1954	5 3/4 - 8	13	7 3/4	22
1955	6 1/2 - 9	15	8 3/4	24
1956	6 1/2 - 9	15 1/2	9	24
1957	7 1/2	15 1/2	9 1/4	28
1958	7 1/2 - 12	16	9 1/4	28
1959	9 - 12	21	10 3/4	31
1960	9 - 12	22	11	32
1961	9 - 12	22	11	32
1962	11 - 14	24	11 1/2	33

Sources: Data from 1951 to 1958 from Sinclair, License Limitation - British Columbia, p. 126. Table 10; since 1958 from British Columbia Catch Statistics.

The Union negotiates minimum prices for salmon but does not regulate the maximum price. There are always some buyers who are willing to pay a little higher than the minimum price; a fact which accounts for the average price received being higher than the minimum.

Vessel ownership and operations are directly related

to the bargaining pressure that the United Fishermen and Allied Workers Union exerts. There are many different types of boats used in fishing. As indicated earlier, fishermen can either buy or rent their craft. This does not answer how, in fact, they actually obtain their boats. Boats are owned in three different ways - (a) by the fishing companies (i.e., processing companies); (b) by individuals but under some financing arrangement such as a mortgage from the fishing companies; and (c) by individual fishermen. As is to be expected, the type of boat to some degree determines the method of ownership. The gillnet and troll vessels are most frequently owned by individuals either in full or under mortgage, although on the Skeena River, many of the Indians operate vessels chartered from the companies. Gillnetters and trollers are usually less expensive than the seiners.

The largest vessel, the seiner, is usually owned either by individuals who charter them to the companies or is owned directly by the companies themselves. On occasion, however, individuals operate their own seiners without chartering them to the fish processing companies. An examination of the Registry of Shipping indicates that the companies have ceased to build vessels themselves since the early 1950's; instead, they appear to prefer to finance the construction of vessels for others. This change in company policy may be due to the rate of return vessels have been able to earn. The actual extent of company financing of vessel construction appears to be fairly high though

no direct estimates are available as to its extent and as to the rate of interest charges, although 5 percent is a figure sometimes mentioned. It has often been suggested by outside observers that this rate is too low, especially when considering the risks and uncertainty to be found in fishing. Much of the capital engaged at present in fishing does not appear to earn a 5 percent rate of return on investment. This point will be discussed later. If the rate of return on investment is so low, it hardly seems sensible for companies to continue to invest indirectly in boats and yet, they continue to do this and to provide other forms of financial assistance to fishermen.

The fishing companies are in competition with each other in an attempt to obtain as large a number of fish as possible. This competition is fierce as the companies all have fish packing plants which they hope to keep operating at full capacity. To obtain the fish they need to keep their plants operating they have been forced by competition into offering individual inducements to fishermen to fish solely for a particular company. The fishermen do not possess equal skill and it is this desire by fishing companies to get "good skippers and crews" which drives them on. The inducements offered have taken a variety of forms, the most prevalent of which has been the sale by the companies of a variety of items. The sale and/or financing of fishing boats was mentioned earlier but companies also sell nets, gear and other related fishing equipment as well as all necessary provisions such as fuel and food. In some circumstances they even offer

cash advances to fishermen. The sale of articles to fishermen is not an incentive in itself, but it is the terms at which these sales are made which make them attractive. Company fishermen often receive discounts and "cheap" credit. Even vessel repairs are done at reduced cost for the "company man". All these facilities are to induce the fishermen to sell their fish to the fishing company that does the financing. The agreements for such fish sales may be formal or solely verbal. This sort of financing and special services acts as an inducement to fishermen to go fishing and is partially responsible for the overcrowded conditions of the industry. Company officials claim that such financing is due to the competitive nature of the industry and that even though some fishermen do not repay their advances, no individual company could cease to offer the inducements and expect to maintain its share of the total catch.

Seine vessels can be operated under a number of varied arrangements. If the seine vessel is owned by a fishing company, the company engages a skipper to operate it. The skipper chooses his own crew and receives a share of the crew's catch equal to that of any other crew member. The skipper also receives some remuneration from the company's share of the proceeds. The skipper's share or bonus is often equivalent to 1/8th of the boat's four shares. The net and the boat must be paid for out of the boat's four shares. Two and one half shares of the net stock go to the boat and 1 1/2 to the net. The captain's bonus is paid by 1/8th of a share from the boat's 2 1/2 shares and also

by 1/8th of a share from the net's shares. Another 1/4th of a share is often given to the captain if he demonstrates special skill and knowledge. This 1/4th of a share comes equally from boat and net.[13] If, however, a vessel is individually owned by a vessel owner, he may operate it under a variety of arrangements. First, the vessel owner may operate the vessel himself and receive a share equal to any other member of the crew. In such a circumstance, he would keep 4/11ths of the net stock to pay for the boat and net. The fishing companies would pay him a commission on the fish he sells to them. This commission would be in lieu of the money the vessel owner would have received if he had chartered his vessel to an individual company. The rate of commission rises rapidly after a certain minimum value of deliveries has been achieved. Secondly, the vessel owner may charter his vessel to the fishing company from anywhere between a few days or for the entire season. Under such an arrangement the vessel owner will receive a specified rental per day whether or not the boat fishes. The boat and the net's share under such circumstances will go to the fishing company that chartered the boat and the vessel owner will have no control or share in its operation. A third possibility is that owner may charter his boat to a fishing company for a smaller fixed sum of money than under the preceeding arrangement and also obtain some percentage of the catch. This percentage varies depending on whether in fact the vessel owner is also the owner of the net

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13 Information supplied to writer by Mr. R.S. Nicholson of British Columbia Packers Ltd., Vancouver, British Columbia.

but it is usually about 10 percent of the gross stock.

Before a vessel will be chartered by a company, the latter may insist that it contain specific equipment. This equipment may be considered as standard equipment to the vessel itself or it may be auxiliary. If the equipment is auxiliary, it usually is paid for by the fishing companies giving a fixed rental to the owner. The power block falls into this second category with the companies paying $400 per annum rental to the vessel owner to compensate him for putting it on the vessel. Some other innovations were introduced first by the companies only to become standard equipment to be provided for by the vessel owner on later charters. The radio telephone is such an example. It was introduced in 1941 on the vessels Limited and Algea and was paid for by British Columbia Packers Ltd. Eventually other vessels adopted it and it became standard equipment. The echo-sounder which is used in herring fishing falls into the same category and so does radar. Representative examples of innovations will be dealt with later. It appears that it is, to some degree, the competitive nature of the fishing companies that leads to the spread of innovations.

Chapter III
Innovation in Theory

In a dynamic society change is continually occurring and affecting all relationships. The rates of change of all variables are never constant and the problem of dealing with variables in a time dimension requires the assumption that a determinate solution is possible. The means to the solution of any dynamic problem may in fact influence the point at which a solution finally occurs. With the introduction of human nature in the form of expectation, risk and uncertainty, the solution becomes even more clouded.

Change is particularly applicable to any discussion of fisheries, if for no other reason than that of its organic component. There are, however, many other dynamic or changing factors in terms of employment, income, investment and catch. This chapter is an attempt to examine how successfully the fisheries adapt to change. In any analysis it would be necessary to limit the discussion between exogenous and endogenous variables. The division line may limit the usefulness of the model but it is a necessary price for this analysis. This paper will discuss the consequences of an exogenous change in the variables of the model. Such a change could be in the form of a natural phenomenon such as a landslide, pollution or disease, etc., which in some way, affected the fish population. A change, on the other hand, could take the form of the introduction of a

new technique or innovation which altered the efficiency of the fishing fleet or individual units in the fleet. It is this second type of change that is related to innovation which will be discussed in the remainder of this chapter. The discussion is intended to explain what an innovation is and what theoretically are its consequences in the setting of the British Columbia fishing industry.

An innovation can be simply defined as the introduction of something new or different. This definition fails to give any detail but it will suffice for this discussion. Although an innovation is something new or different, it does not have to involve the introduction of a new piece of physical equipment; it may be only the introduction of a new system or scheme of utilizing the existing factor inputs in a manner which yields either an increased output at the same cost or a constant output at a decreased cost, or the same output in less time. To make this analogy complete, an example may be in order. Suppose that all factor quantities remain the same but by re-organizing the floorspace or the procedure that is followed, it were possible to reduce the time required to make the same number of units of output, this would be an innovation since the time required would be reduced, thus permitting at least one factor to be used elsewhere for part of the time, i.e., either labour and/or liquid working capital would not be required for as long a period of time and could now be utilized elsewhere. If the innovation resulted in all resources being freed they could now

be used either to increase the total output at the same total cost or be utilized in lowering the cost of the fixed number of articles sold. Depending on the demand conditions for the final production, the appropriate combination of the two will likely be chosen.

An innovation may also consist of the introduction of a new type of gear or equipment or the modification of an existing piece of machinery. The consequences of an innovation are not affected to any degree whichever approach is taken, that is, whether the innovation involves an organizational or a physical change. For the sake of convenience it has been decided to examine only a portion of the British Columbia fishing industry and to note the changes and modifications which it has undergone in response to exogenous changes or innovations. The salmon share system appears to be the most important and therefore the best system to study, though in fact, in this branch of fishing the formula is only applicable to purse seine boats.

The best way to examine innovation and its relationship to the share system is by classifying the new techniques in terms of their effects on labour and capital. It is assumed that there are only two factors of production, i.e., labour and capital. Some innovations are labour saving, others are labour using and still others continue to use a constant amount of labour. Similarly, innovations may also be either capital saving, capital using, or capital constant. It is also possible to have varying combinations of the two. All innovations must necessarily

fall into one or more of the above classifications. The significance of the classication is that an innovation probably will affect the relative share of the total return going to a particular factor. It is well to remember that the share of the total which is altered by an innovation may be due to a marginal change and not to a complete and full change of the whole process, thus the change in the final or total reward to each factor may not be large.

To aid in understanding the whole procedure of the share system and its relationship to innovation, it is worthwhile to start with a basic model which will be modified according to changing situations. A model of a single vessel occupied in capturing fish on a year-round basis is constructed. It is assumed that there is only one species of fish and that the supply of fish facing the vessel is unlimited, therefore it is in the interest of the fisherman to ccapture as many fish as he possibly can, assuming, of course, that demand for his product is perfectly elastic. Under such sircumstances, the fisherman will attempt to catch fish until his marginal return is equal to his marginal cost. The marginal return is based on the price he receives for the last unit of fish caught and sold. The marginal cost in the short run is based on the variable costs which must necessarily be covered if the boat is to operate. These costs include all current expenses for fuel, food and gear. In the long-run, however, the long-run marginal cost must be covered by the long-run marginal revenue, that is to say, sufficient revenue

must be forthcoming to cover depreciation and wages, or an income equivalent to wages in alternative employment, as well as the previously mentioned variable costs. The introduction of an innovation will lead the vessel to increase its catch of fish until a new equilibrium is established when marginal cost and marginal revenue are equal.

The above illustration explains the situation for a single vessel, but what is the situation if there are a number of such vessels fishing? To demonstrate this, it is further assumed that all vessels in the fishing fleet are identical in their capacity and skill of operation. Then, under such circumstances, all vessels will continue to equate their identical marginal revenues with their marginal costs. This is the situation which would be found in stationary equilibrium. If the above situation exists prior to the introduction of an innovation, it is possible to study the consequences of the same. When a new technique is first introduced, the vessel which is fortunate enough to possess it will obtain an advantage in that it will have a lower average cost per unit of output. The vessel will probably expand its output and it will enjoy higher profits. It does not matter whether the total quantity of fish in the ocean is limited or not because if the number of fish available for capture is limited, then the new and more efficient vessel will reduce the catch that would have been available to other vessels. The whole fleet cannot gain by an innovation if the quantity of fish is limited unless the new innovation is such that it lowers the total cost

of capture, or presents some external economies to other vessels, or unless it changes the demand curve for the final product.

This section presents a group of numerical models which are to explain in a simplified form the theoretical basis of the share system. The first models describe the introduction of a new innovation into a fishery which is not working under the share system. The innovation in these models is assumed to have a capital cost of $500 and to have a life expectancy of a single year. Time A is assumed to be a one-year period in which the innovation is not present. Time B is a one-year period in which it is present. The price of the catch is assumed constant in both periods and there is assumed to be only one species of fish of a homogenous quality. The total supply of fish is assumed to be equal and fixed in both periods. All boats are assumed to be of equal size and quality and the skill of the skippers is assumed to be constant. Variations due to fluctuations in catch or due to various risks and uncertainty are assumed away. The net stock is assumed to be the total value of the fish caught, all allowances and deductions having been made for running expenses. Payments to capital consist of the depreciation and interest that go to the boat owner. Payments to labour are the total of fishermen's remuneration. Net profit is the profit remaining after meeting all expenses. This is assumed to be zero in period A as all boats are in equilibrium. Boat X represents a particular boat from whose point of view all the following problems are examined. Boat Y represents the

rest of the fishing fleet.

The first three cases, A, B and C, are purely capitalistic in that they demonstrate the effects of innovation outside of the share system. The boats are not operating on the share system although the 4/11ths and 7/11ths basic shares are used as the expense ratio. Under such a system, any profits or losses are charged solely to capital.

Case A - This represents the situation when no vessel has the innovation, and is, under ceteris paribus assumptions, the long-run equilibrium position:

	Net Stock	Gross Benefit from Innovation	Additional cost to Capital	Shares Payment to Capital	Shares Payment to Labour	Net Profit to Capital	Net Profit to Labour
Boat X, Time A	$6000	$ -	$ -	$ 2182	$3818	$ -	$ -
Boat X, Time B	6000	-	-	2182	3818	-	-
Boat Y, Time A	6000	-	-	2182	3818	-	-
Boat Y, Time B	6000	-	-	2182	3818	-	-

Case B - Boat X has the innovation in Time B, whereas Boat Y has not. The net profit of $500 is the incentive which makes the vessel owner utilize a new innovation. Boat Y in time suffers a net loss of $1000 which must be borne solely by the capitalist in the absence of the share system. Case B is illustrated as follows:

	Net Stock	Gross Benefit from Innovation	Additional Cost to Capital	Shares Payment to Capital	Shares Payment to Labour	Net Profit to Capital	Net Profit to Labour
Boat X, Time A	$6000	$ -	$ -	$2182	$3818	$ -	$ -
Boat X, Time B	7000	1000	500	2682	3818	500	-
Boat Y, Time A	6000	-	-	2182	3818	-	-
Boat Y, Time B	5000	-1000	-	1182	3818	-1000	-

Case C - Case C represents the case where Boat X has the innovation in Time B and Boat Y has not. In this case, however, labour has managed to increase its wages and thereby to remove all the net profit of $500 which went to the entrepreneur in Case B. This is illustrated as follows:

	Net Stock	Gross Benefit from Innovation	Additional Cost to Capital	Shares Payment to Capital	Shares Payment to Labour	Net Profit to Capital	Net Profit to Labour
Boat X, Time A	$6000	$ -	$ -	$2182	$3818	$ -	$ -
Boat X, Time B	7000	1000	500	2182	4318	-	500
Boat Y, Time A	6000	-	-	2182	3818	-	-
Boat Y, Time B	5000	1000	-	1182	3818	-1000	-

Labour could only manage to raise its wages if it possessed monopoly

monopoly of the labour for Boat X. Under the above circumstances, the vessel owner would be indifferent to applying the new technique as it only just pays for itself without allowing a surplus for himself. The vessel owner is in the zone of indifference. If the cost of the innovation had been less, then the labourers could have pressed for an even higher share for labour.

The share system that is applicable at present to the British Columbia salmon industry is based on a 4/11ths and 7/11ths division of the net stock. How then does this appear to influence the rate of innovation in the light of what has been discussed? The net stock in the previous examples was divided under the salmon share formula but this formula was not applied to the division of the return from the new innovation. The effect of the salmon share division appears to be quite striking.

Case D - In Case D the net stock increases by a total of $1000 and yet the additional benefit to the capitalist was only $364 of this total, as is shown in the table on the following page. This small return to the capitalist was due to the share system. The immediate effect of such a return will be to reduce the desire of the vessel owner to innovate. This example demonstrates that an innovation which will yield an increase in the net stock of $1000 will not be undertaken if it costs the capitalist more than $364 to implement it. Thus any innovation that does not have a marginal return which is at least 2.75 times

its cost is not worthwhile introducing from the boat owner's point of view. The following table illustrates Case D:

	Net Stock	Gross Benefit from Innovation	Additional Cost to Capital	Shares Payment to Capital	Shares Payment to Labour	Net Profit to Capital	Net Profit to Labour
Boat X, Time A	$6000	$ -	$ -	$2182	$3818	$ -	$ -
Boat X, Time B	7000	1000	500	2046	4454	364	636
Boat Y, Time A	6000	-	-	2182	3818	-	-
Boat Y, Time B	5000	-1000	-	1818	3182	-364	-636

The figure of 2.75 times cost is derived from one divided by the vessel's share or 4/11ths. Case D also demonstrates the effect of the share system in covering a loss. Boat Y in time B has suffered a loss which under a capitalistic arrangement, such as Case C, would have been borne solely by the vessel owner, instead, due to the share system, the major burden is shifted to the fishermen and the vessel owner's burden is reduced.

Case E - The above innovation was capital using. If, instead, the innovation were capital saving and reduced the need for capital by $500, the results would be as those which are shown by the table on the following page.

If the innovation is capital saving, it need not affect the total catch or the net stock. The catch will remain the same unless the money which was saved were re-invested in

new equipment to capture more fish. The vessel owner has every incentive to implement this technique as it will give him a windfall profit. This windfall may attract attempts by the fishermen or those paid by labour's share to seek to change the share arrangement so as to partake in the windfall.

	Net Stock	Gross Benefit from Innovation	Additional Cost to Capital	Shares Payment to Capital	Shares Payment to Labour	Net Profit to Capital	Net Profit to Labour
Boat X, Time A	$6000	$ -	$ -	$2182	$3818	$ -	$ -
Boat X, Time B	6000	-	- 500	2182	3818	500	-
Boat Y, Time A	6000	-	-	2182	3818	-	-
Boat Y, Time B	6000	-	-	2182	3818	-	-

Case F - Case F involves a labour saving innovation which does not require any increase in the quantity of capital. It would appear to be similar to that of Case E except the payment for labour would now be reduced by $500. However, it may not be as simple to reduce the payment to labour and, in fact, what may happen is that the labour force will be reduced but the total payment to labour will remain the same. The workers who remain on the job will have received a windfall gain. The capitalist might attempt to change the share arrangement so that he can obtain at least some of the reward. Any change in the share allocation will be strongly resisted by labour. If the capitalist is unsuccessful in obtaining a new share arrangement or a modification of the old, he may continue to operate under the old technique utilizing the same amounts of labour and capital as before. The

capitalists neglect to implement the new innovation will thus keep the potentially increased wages from the fishermen. Such behaviour may be due to jealousy or laziness on the part of the capitalist. If, however, some vessels do reduce the size of their crew, the ambitious and energetic crewmen will leave the vessel with the larger crew and attempt to get on to the vessel that pays a higher return for their effort. Thus in the end the capitalist may be forced to innovate to keep the good crewmen that he already has on his vessel. Case F is illustrated below:

	Net Stock	Gross Benefit from Innovation	Additional Cost to Capital	Shares Payment to Capital	Shares Payment to Labour	Net Profit to Capital	Net Profit to Labour
Boat X, Time A	$6000	$ -	$ -	$2182	$3818	$ -	$ -
Boat X, Time B	6000	-	-	2182	3318	500	-
Boat Y, Time A	6000	-	-	2182	3818	-	-
Boat Y, Time B	6000	-	-	2182	3818	-	-

If the labour saving technique requires a little capital it might still be employed under the present share arrangement as long as the return on the investment, i.e., the additional benefit to capital, is increased by at least 2.75 times the initial required new investment. A return of 2.75 times the initial investment is required to compensate the capitalist if any innovation is to take place under the share system. This is due to the fact that all returns from a new innovation are shared with labour before the cost of the new investment has been met.

If an investment was implemented under the above 4/11ths and 7/11ths share system and it failed to yield a return of at least 2.75 times its cost, then the capitalist would be unable to even recoup his original investment. Under a purely capitalistic system as long as an investment yields at least its costs the capitalist does not suffer a capital loss.

Innovations may be summarized to show the various possible combinations of capital and labour. The following list is such a summary:

			Capitalist's Attitude (1)	Labour's Attitude (2)
Capital Saving	-	Labour Using	Favourable	?
Capital Saving	-	Labour Saving	Favourable	Favourable
Capital Saving	-	Labour Constant	Favourable	Favourable
Capital Using	-	Labour Using	?	?
Capital Using	-	Labour Saving	?	Favourable
Capital Using	-	Labour Constant	?	Favourable
Capital Constant	-	Labour Using	Favourable	?
Capital Constant	-	Labour Saving	Favourable	Favourable
Capital Constant	-	Labour Constant	Favourable	Favourable

This list shows all possible combinations of innovations as to their utilization of labour and capital. Column 1 gives the attitude of the capitalist to an innovation which will increase the net stock and which will require additional demands on the respective factors. Column 2 gives the attitude of labour to the proposed change. These innovations which the respective group approves are noted as favourable, while those which are uncertain are questioned.

The presence of a question mark in columns 1 and 2 indicates those types of innovations which possess a degree of

uncertainty and where additional difficulties are present due to the share system. The innovations or changes which are questioned in column 1 will not be implemented unless the return on the capital invested is at least 2.75 times the invested capital. Those innovations questioned in column 2 will be opposed by labour who would not wish their implementation unless the net increase in the net stock is at least 1.57 times the increased burden on labour. This increased burden is equal to the increased number of men times their respective share. The figure 1.57 times the increased burden or cost is derived from one divided by labour's share or 7/11ths. It is similar to the figure 2.75 which was derived for capital. If the share system were not in force, and the system in use was solely based upon the long-run marginal productivities of the factors, then it would be expected that any innovation would be utilized as long as it had at least, or better than, a one-to-one relationship between increased cost and increased product. Only four out of the possible nine types of innovations fall into the category where the one-to-one relationship would hold under the share system. The other five face a variety of hindrances. The actual percentages by which the marginal product must exceed the marginal cost depends on the actual circumstances of the share system. However, under any share system, when both factors are considered, the lowest figure by which the marginal return must exceed the marginal investment is 1.57 times and this occurs only when there are half shares.

Chapter IV

Innovation in Practice

After completing a study of the theoretical background, it is imperative to turn to the facts, and to the institutional framework to examine how the fishing industry works in practice. In British Columbia the type and degree of innovation is strongly influenced by the elaborate system of regulations imposed on salmon fishing by the Fisheries Department of Canada and the International Pacific Salmon Fisheries Commission. The main objectives of these two bodies seem to be (a) the conservation of the salmon species, and (b) the maintenance of employment opportunities for fishermen. To obtain these objectives they have implemented regulations governing such matters as the size of nets, the colour and size of mesh allowed and the areas in which purse seining may take place. No limits have been placed on the number of boats and men allowed in each branch of the fishery, but strict limitations have been placed on the periods during which fishing is allowed and on the total amount of fish that can be caught.

If the regulations had other objectives, e.g. maximum efficiency regardless of employment, then the type and direction of innovation would probably have been quite different. Seiners would probably have replaced trollers and gillnetters, while if fishermen were to be dispensed with almost entirely, fish traps might have dominated. The regulations that govern the industry

have a significant effect on innovation and also on the employment and incomes of fishermen.

It is not really possible to estimate the number of the innovations which have been rejected, or not applied, due to the share system. It may be questioned whether, in fact, an innovation actually takes place if it is not introduced, but even leaving this point aside, it is difficult to find examples where an innovation has been specifically rejected on the grounds that it failed to give a yield of 275 percent of its cost. This chapter instead will attempt the next best thing and will discuss some examples of innovations which might fall into the five categories of innovations which were mentioned as likely points of conflict.

Before proceeding further it is worthwhile to note that the fishing industry displays a high degree of variability in its catches from year to year. This variability, however, is mild in comparison to that sometimes found among boats, even those which are fishing in the same areas at the same time. This variability naturally makes any sampling procedure open to criticism unless the sample is both large enough and unbiased. The examples which will be presented on the following pages have not been drawn from a random sample and therefore are open to criticism on this ground. The main feature of these examples, however, is that they are an attempt to organize all available data. The paucity of relevant data which are freely available has been a serious problem. The information, however, is believed

to be both reliable and realistic; attempts at verification through conversations with those engaged in industry appear to support the conclusions the figures imply.

NYLON NETS

The first innovation to be examined is one that is capital using and which has almost no increased labour requirements. It is the introduction of nylon fishing nets, the history of which is briefly as follows. Prior to 1950 all nets had been made of material other than nylon, with linen being the predominant material. In 1950 and 1951 the new nylon nets were used experimentally, and in 1952 approximately 500 nets were released to fishermen. The nets were bought directly from the supply house and the demand was so large that by August 1952 the two major and one minor suppliers in the field were unable to meet the demand. In 1953 five other companies entered the supply field and a factory to manufacture nylon nets was opened in British Columbia.

It is rather difficult to talk about fishing nets in general terms as they differ in design and in the variety of the material used. The cost of a net varies depending on such things as the weight and size of the twine and whether a double or single knot construction is used, etc. Nylon nets are almost twice as expensive as linen nets. The "tangle net" which had widespread popularity at this time was woven out of No. 23 nylon twine. It was very fine and less expensive than the regular

sockeye net. Tangle nets did not gill the fish but only, as the name implied, entangled them. Such nets had a very short serviceable life and frequently lasted only six weeks or less. The very fine twine also made repairs very difficult. The Department of Fisheries finally declared tangle nets illegal as of January 1, 1954. The stronger nets used for sockeye were usually made out of the No. 53 twine. They were frequently woven in a double knot pattern and had a serviceable life of two seasons. The lead line and the corks were not changed but nylon was used for the hanging and the selvage which attached the web to the lines.

Nylon nets presented some specific problems to the manufacturers both in construction, dyeing and general care. Double knots had to be used in the construction of the meshes and to counteract slipping and shrinkage problems. Dyeing nylon twine was also a difficult process. Nylon also was easily affected by sunny and warm weather which shortened its life expectancy. These problems were all finally surmounted. Nylon nets have the following particular characteristics: (1) they resist bacteria and mildew, thereby suffering no deterioration from being stored; (2) they absorb little water and therefore are not as heavy; (3) they are 10 percent to 20 percent weaker than linen nets when wet which means that they must be larger to give the same strength.[1]

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1 "Trends in the Usage of Nylon Twine and Web", Western Fisheries, March 1952, pp. 18-19, 62. See also S.L. Young, "Nylon

When nylon nets were first introduced various techniques were used.[2] Some fishermen attempted to interspace both linen and nylon sections in their nets, but they failed to notice any appreciable difference in the number of fish caught by each segment of the net. The general concensus on the part of fishermen is that completely nylon nets are better. They suggested that the chief reason is the ability of nylon nets to be fished successfully during the daytime in relatively clear water. Linen nets have more noticeable meshes and the fish are able to avoid these nets. In 1952 the main part of the sockeye run passed into the Fraser River while the water was still relatively cloudy due to silt and debris carried by the river during the spring run-off. Linen nets did not appear to be at

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Tested on West Coast", Trade News, February 1952, Canada, Department of Fisheries, pp. 8--9. This paper deals with a comparison of the physical properties of nylon, linen and cotton salmon twine. The strength of wet linen salmon twine is set arbitrarily at 100.

	Nylon	Linen	Cotton
Twine Strength, dry	91	74	23
Twine Strength, wet	77	100	25
Mesh Strength, dry	108	69	28
Mesh Strength, wet	85	110	33
Stretch under breaking tension, dry	385	60	2900
Stretch under breaking tension, wet	395	100	360
Toughness, dry	350	45	65
Toughness, wet	300	100	90

Also noted is nylon's wear resistance and ability to stretch. Nylon is more expensive and broken meshes fray in water making repairs difficult.

2 Report on Nylon Nets, Canada, Department of Fisheries, Unpublished, 1952.

too much of a disadvantage during July of this year, but when the water cleared, nylon nets proved to be superior.

No data are available on the utilization of nylon seine gear, and though the first net was made up in 1952, it was not utilized in that year. Most vessels have now converted to nylon, though some linen gear does remain in use. Nylon was first utilized by gillnet boats on the Fraser in 1952. In that year, a survey on the catching efficiency of nylon and linen gear was undertaken by Mr. T.F. Rothery, a Fisheries Officer at Steveston, B.C.[3] The survey is based on an examination of the catches at the mouth of the Fraser River in the Steveston-Sandheads area during and after the sockeye run of that year. It indicated the greater efficiency of nylon nets. Mr. Rothery's method was to examine two groups of fishermen, one group of which was using nylon nets, the other using linen. The fishermen in the sample were not chosen at random but were selected on the basis of their fishing experience and the equipment, other than the nets that they utilized. Mr. Rothery was well aware of the abilities of various fishermen and was therefore capable of making such sound judgments.

The survey was actually based on the catches of two groups of boats during two periods of time. In all, the survey included information based on 94 boat periods. The first period extended from July 1 to August 4 and the second from August 5 to

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3 Report on Nylon Nets.

September 5. The following table explains the catches which were made by the 32 boats during the first period and 62 boats during the second period:

Group 1 July 1 - August 4, 1952	No. of Fish Caught	Total Weight in lbs.
16 Linen nets	16,786	123,575
16 Nylon nets	23,866	181,059
Group 2 **August 5 - September 5, 1952**		
31 Linen nets	11,936	96,859
31 Nylon nets	24,489	207,065
Groups 1 and 2		
47 Linen nets	28,722	220,434
47 Nylon nets	48,355	388,124

During both periods one half of the boats used linen nets and the other half nylon nets. The number of separate pieces of each species and their respective weights are not identified in this example. This detail, in fact, showed nylon nets during the first period July 1 to August 4 to be more efficient in capturing all species except chum and steelhead, but even in these categories the difference did not appear to be important. The results from the second period August 5 to September 5 appear to be more significant since during this period boats using nylon nets outfished their competitors both in the number of fish landed and in the size of the fish they caught. An examination of the detailed figures shows nylon nets to have been more efficient. The following table shows the catch by weight and

and species for vessels in the sample:

Sockeye	No. of Fish	Pounds	Coho	No. of Fish	Pounds
Linen	23,939	171,860	Linen	3,193	22,247
Nylon	39,200	287,106	Nylon	5,109	33,103
Red Spring			Chum		
Linen	662	10,431	Linen	109	1,597
Nylon	2,049	33,746	Nylon	447	6,592
White Spring			Steelhead		
Linen	779	23,795	Linen	40	504
Nylon	1,502	26,937	Nylon	48	640

There are 94 boat periods but only a total of 62 boats in the sample, since the vessels examined during the first period are also in the sample of boats in the second period. In the combined period, July 1 to September 5, nylon nets captured 19,633 more salmon, which were equivalent to 167,690 pounds more weight. Thus during this period, vessels fishing with nylon nets were 68.3 percent more efficient than those fishing with linen nets. For example, if it is assumed that there are no fixed costs, then a linen net which cost $1,000 and just paid for itself in the season would be equivalent to a nylon net which cost $1,683 and yielded in return a 68.3 percent increase in the catch. If the cost of the new nylon net is less than 68.3 percent, then it would be utilized if there were no share system. In the gillnet fishery, a share system based on 4/11ths and 7/11ths is not applicable, and if the vessel operation requires only one man, the above is the only consideration that need be

examined. However, if the fishing operation utilizes two men, and the catch is divided on the customary basis of 2/3rds to the captain and boat owner and 1/3rd to his assistant, problems arise, for under this system, only 2/3rds of the increased catch would go to the vessel owner and be available to meet the cost of the net. Thus it would appear that if the linen net cost $1,000 and yielded $1,000, it would only be worth utilizing a nylon net if it cost less than $1,455 and yielded $1,683. If it were possible to utilize these catch figures in reference to the salmon seine share agreement, then under this agreement only 4/11ths of the increased catch would go towards the boat and gear and thus the relevant information would be that the nylon net would have to cost less than $1,247 and yield $1,683 to be worthwhile adopting.

Nylon nets have continued to grow in popularity and now supply almost the total market for netting. Why has this phenomenon occurred? The samples, based on the catches of two groups of fishermen, are not really justifiable as the two groups are highly dependent on each other. This is true particularly in the case of the salmon runs since the supply is regulated for conservation purposes. As fishermen turn to nylon nets and capture more fish in a shorter period of time, there are fewer fish available to be caught in linen nets. Thus as the catches per nylon net at first increase, the total number of fish caught per unit of linen net will decrease. The fewer fishermen that use nylon instead of linen, the greater will appear the superiority

of nylon. The individual fisherman who first utilize the nylon net enjoy an advantage at the expense of those who retained linen nets. This advantage will be eaten away as more boats commence to use the new nets. The results logically appear to point to a need for fewer fishing boats with each boat obtaining a larger share of the total catch than it did with linen nets. In fact, this does not appear to be what is happening. This problem will be examined again later.

PURSE SEINERS

The origin of purse seining on the Pacific coast is uncertain. John Cobb credited its origin to Chinese fishermen in 1886,[4] while Rounsefell and Kelez [5] quoted Hittel and suggested that it was an important gear as early as 1882. The original purse seine vessels were sail boats; but in 1903, the first gasoline engine was used on salmon purse seiners. The power-equipped boat "... easily demonstrated her vast superiority over other purse seiners in the quickness with which she could reach a school of fish after it was sighted and in surrounding it with her seine." [6] These first power seine boats

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4 John Cobb, Pacific Salmon Fisheries, 3rd ed. (Document No. 902), May 1921, Report of the Commissioner of Fisheries, Washington, D.C., U.S. Government Printing Office, 1922, p. 78.

5 George A. Rounsefell and George B. Kelez, "The Salmon and Salmon Fisheries of Swiftshore Bank, Puget Sound and the Fraser River", Bulletin No. 27 (October 17, 1938), Bulletin of the United States Department of Fisheries, vol. XLVIII, Washington, D.C. U.S. Government Printing Office, 1940, p. 726.

6 John Cobb, op. cit., p. 78.

were small in size, at approximately 30 feet. Boats soon began to increase in size once the technique had proved itself to be successful. High power and speed which had once been unnecessary now became of great importance and the newer boats soon cast their predecessors in the shadow. The new vessels began to range in size from 45 to 55 feet and to be powered by 45 to 75 horsepower engines and later reached as much as 80 to 90 feet. In conjunction with increased size, motor power was soon attached to winches for hauling. The gasoline-power seine boat was universal in Puget Sound by 1907.[7] In the years following, many other improvements and innovations took place; such things as turntable and roller mechanization, hydraulic engine throttle and clutch control, and the diesel engine, to name a few. The history of purse seine salmon fishing provides many innovations which can be examined profitably. However, it will suffice to deal with some of the more modern ones which can act as representative examples.

In seine fishing, the type of gear used is the purse seine. The purse seine net is made either from nylon or cotton twine and is supported on the surface by Spanish cork or Spongex (plastic) floats. The purse line runs along the bottom of the net through metal rings which are attached to the bridles which are in turn fastened to the lead line.

When scouting for fish, the seine vessel proceeds until the crew observe some indication that a school of fish

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7 Rounsefell and Kelez, op. cit., p. 728.

might be present. When the school has been located a small seine skiff is launched with one end of the net. The seine boat then proceeds to release the remainder of the seine from the stern of the vessel as it encircles the school. Once having satisfactorily accomplished this and having retrieved the other end of the net from the skiff, the seine is pursed by drawing in the purse line which seals off the bottom of the net entrapping the fish. Various devices, such as air hoses, lights and wooden paddles, are used during this operation to scare the fish away from the opening at the bottom and side of the net beside the boat. The next operation consists of hauling the net onto the vessel until only a small portion remains enclosing the fish alongside the vessel. The fish are then removed from the net and into the hold with the help of a power-driven dip net or brailer.

Historically, all purse seine vessels were table seiners. The table is a large movable platform on the stern of the vessel from and onto which the seine is launched and collected. The usual operation was to haul the seine on board by hand; an operation which took approximately 45 minutes. The introduction of the power drum and the Puretic power block revolutionized the speed of this operation and modified the vessels. Both these innovations are of relatively recent origin and it is worth noting how they were treated in the light of the share system.

The conversion of purse seine boats from table to drum

seine operations was an innovation of notable importance. Such a conversion is,from the capitalist point of view, an innovation which is capital using and labour saving, at least, in the short-run. Capital using and labour saving innovations are among that group of questionable innovations over which disputes are likely to occur. The conversion of a vessel from table seining to drum seining requires an expenditure by the capitalist and less hard physical work for labour, but a more constant and arduous work by a smaller number of fishermen. The need for fewer fishermen makes this innovation labour saving, and yet for those fishermen who remain on the vessel, the work load has increased. To these remaining fishermen the innovation appears to be labour using as it require more effort on their part. They will be opposed to the innovation unless they obtain sufficiently large increased earnings to pay for their increased effort. The fixed share system automatically insures them of at least some increase in earnings due to the smaller-sized crew.

Salmon purse seine fishing based on the principle of the drum was of little importance in British Columbia before 1952. The first drum purse seiner was introduced in 1947. In 1951 approximately six drum seine vessels were engaged in seeking salmon. Their operations appear to have enjoyed a noticeable success and as a consequence, a number of vessels were converted from table seine to drum seine operations. During the year 1951-1952, seven new drum seine vessels were built [8]

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8 Sinclair, License Limitation, p. 154.

and a total of about 30 drum type vessels were engaged in salmon fishing in 1952. This vessel total had increased to 75 vessels by 1955 and has continued to grow ever since.

When a seine vessel is equipped with a power drum, the actual setting operation remains relatively the same as mentioned previously. However, there are a few parts of the operation which differ. Unlike table seining, the net in drum seining is only half pursed before the hauling in begins. This half-pursing enables the set to be completed in a shorter time period but also presents an opportunity for the fish to sound and to escape. However, the basic difference in drum and table seining is in the hauling of the net mechanically. In drum seining the seine net passes over a roller and around a drum which is located in the stern of the vessel. The power drum which is mechanically operated removes the heavy pulling work which the crew had to undertake formerly when retrieving the seine. This reduction of work eliminates the need for a seven man crew. Five men are now sufficient to handle a drum seiner in comparison to a table seiner which requires the seven men. The salmon seine share arrangement which was in effect on all purse seiners in 1952 stipulated that the fisherman's share of the catch was to be 7/11ths. The advent of the drum seine reduced the vessel crew to five workers who were able to obtain that which had previously been divided among seven. The remaining crew was also to gain further from the increased efficiency of drum seine vessels.

DRUM SEINE

The invention of the drum seine has been credited to Nicholas Kelly of Nanaimo, B.C. in 1951.[9] He introduced a drum with a level winding mechanism for handling the entire purse seine. After a set had been made, the net was retrieved by winding it around a large drum located at the stern of the boat. This innovation removed the need for either hand-pulling the seine over a live roller at the edge of the seine table or, in the case of the large seines, the strapping in of portions of the seine. The drum seiners have appear to be quite successful. The crediting of this innovation to Nicholas Kelly may be correct but it is certain that the seine tables had been replaced by seine drums on at least two vessels, the Tarzen and Greyfish, as early as 1947.[10] The innovation of the power drum for seine vessels represented merely an extension of a principle which had been used for a number of years previously by gillnetters. The implementation of the power drum on these boats had made one-man operation of gillnetters possible.

Drum seiners, at least in some areas of the British Columbia coast, are more efficient than table seiners; this is

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9 Peter J. Schmidt, Jr., "The Puretic Power Block and its Effects on Modern Purse Seining", in Modern Fishing Gear of the World, ed. Hilmar Kristjonsson, London, Fishing News, Food and Agricultural Organization of the United Nations, 1959, p. 400.

10 W. Rigby, Statement to Conciliation Board on Drum Seine Dispute, United Fishermen and Allied Workers Union, 1954, p. 8.

particularly true of the Northern Area especially where the water is not too clear. Experiments by drum seiners in the clear water of Juan de Fuca Straits have proved disastrous for all those who attempted it. The reason for their failure in this area was the clear water which permitted large fish escapement from the net. Northern drum seiners, however, have continued to experience larger catches than their table seining competitors. Drum seiners usually catch fewer fish per set of equivalent gear than do table seiners, but the former make up for this loss by more frequent sets per diem.

In the early years, the conversion of table to drum seiners cost, on the average, between $8,000 and $10,000. This has now fallen to approximately $6,000 and the equipment has improved from the original chain drive to piston drive operations. The drum seiner also incurs other extra expenses, and relatively expensive Spongex floats must be used in place of Spanish cork which fails to stand up under the extra pressure imposed by winding the net around the drum. The maintenance cost of the drum purse seine tends to be higher and since it is set more frequently it wears out faster. The crew on the vessel, though not working as hard physically, do work more continuously and steadily. This latter factor makes drum seine work more arduous.

All the above then are to be compensated for by the increased profits which should accrue from the operation of the drum seine. Table 2 which shows, in index form, the value of

To follow page 69

Table 2

Seine Boat Production 1953 - 1962
Index of the dollar value of Catch

Type	Seine Boats	Gross Tonnage	No. Crew	1953	No. Crew	1954	No. Crew	1955	No. Crew	1956	No. Crew	1957	No. Crew	1958	No. Crew	1959	No. Crew	1960	No. Crew	1961	No. Crew	1962	Total Seasons	Total Production
Table	No. 1	29	6	139	6	448	6	361	6	39	6	169	6	543	6	417	6	435	6	561	6	1082	10	4194
Table	No. 2	20	6	113	6	552	6	543	6	296	6	265	6	639	-	--	-	-	-	-	-	-	6	2408
Drum	No. 2	-	-	-	-	-	--	-	-	-	-	-	-	-	5	409	5	560	5	856	5	1256	4	3081
Table	No. 3	24	6	191	6	317	6	152	6	439	6	274	-	-	-	-	-	-	-	-	-	-	5	1373
Drum	No. 3	-	-	-	-	-	-	-	-	-	-	-	4	452	4	574	4	270	4	961	4	1174	5	3431
Table	No. 4	20	6	239	6	478	6	135	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	852
Drum	No. 4	-	-	-	-	-	-	-	4	256	4	387	4	1369	4	417	4	295	4	904	4	1078	7	4706
Table	No. 5	34	6	191	6	543	6	200	6	291	6	287	6	561	6	165	6	239	5	574	-	-	9	3051
Drum	No. 5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	1517	1	15 17
Drum	No. 6	18	6	165	4	613	3	374	3	765	3	809	3	1317	4	360	4	617	4	474	4	1039	10	6533
Table	No. 7	37	6	383	6	761	6	322	6	396	6	400	6	569	5	387	5	239	5	948	5	1330	10	5735
Table	No. 8	30	6	391	6	591	6	235	6	339	6	461	-	-	-	-	-	-	-	-	-	-	5	2017
Drum	No. 8	-	-	-	-	-	-	-	-	-	-	-	4	517	4	74	4	404	4	483	4	504	5	1982
Table	No. 9	19	6	126	6	178	6	60	-	-	-	-	-	-	-	-	-	-	--	-	-	-	3	364
Drum	No. 9	-	-	-	-	-	-	-	4	130	4	343	4	574	4	187	4	222	4	287	4	713	7	2456
Table	No. 10	42	6	317	6	513	6	335	6	332	6	613	6	752	6	274	5	357	5	696	5	1073	10	5252
Table	No. 11	26	6	426	6	404	6	183	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	1013
Drum	No. 11	-	-	-	-	-	-	-	4	435	4	335	4	578	3	452	3	700	3	913	3	1283	7	4696
Table	No. 12	27	6	365	6	700	6	300	6	456	-	-	-	-	-	-	-	-	-	-	-	-	4	1821
Drum	No. 12	-	-	-	-	-	-	-	-	-	4	313	4	839	4	426	4	422	4	621	4	904	6	3525
Table	No. 13	25	6	191	6	452	6	200	6	461	-	-	-	-	-	-	-	-	-	-	-	-	4	1304
Drum	No. 13	-	-	-	-	-	-	-	-	-	4	378	4	365	4	452	4	534	4	800	4	1465	6	4094
Table	No. 14	42	6	630	6	535	6	257	6	230	6	448	6	800	6	307	6	226	6	456	6	791	10	4680
Table	No. 15	22	6	217	6	483	6	252	6	443	-	-	-	-	-	-	-	-	-	-	-	-	4	1395
Drum	No. 15	-	-	-	-	-	-	-	-	-	4	626	4	526	4	86	4	687	4	543	4	2239	6	4707
Table	No. 16	38	6	230	6	504	6	357	6	556	6	73	6	652	-	-	-	-	5	604	5	904	8	3880
Drum	No. 16	-	-	-	-	-	-	-	-	-	-	-	-	-	5	265	5	378	-	-	-	-	2	643
Table	No. 17	29	6	261	6	504	6	274	6	361	6	591	6	1209	5	417	5	309	5	556	5	904	10	5386
Table	No. 18	-	6	174	6	543	6	91	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	808
Drum	No. 18	21	-	-	-	-	-	-	4	526	4	474	4	739	4	287	4	226	4	869	4	1221	7	4342
Table	No. 19	32	6	200	6	587	6	230	6	261	5	517	--	-	-	-	-	-	-	-	-	-	5	1795
Drum	No. 19	-	-	-	-	-	-	-	-	-	-	-	4	617	4	217	4	313	4	904	4	939	5	2990
Table	No. 20	46	6	148	6	265	6	235	6	287	6	461	5	1174	5	404	5	261	5	504	5	1104	10	4843
Table	No. 21	24	6	100	6	522	6	96	6	291	6	248	6	578	6	278	5	200	5	469	5	704	10	3486

TABLE - Seine Total	5032	9880	4818	5468	4807	7477	2649	2266	5368	7892
DRUM - Seine Total	165	613	374	2112	3665	7993	4206	5628	8615	15332
TOTAL NUMBER OF VESSELS										
- Table Seiners	20	20	20	16	13	10	8	8	9	8
- Drum Seiners	1	1	1	5	8	11	13	13	12	13
AVERAGE CATCH PER VESSEL										
- Table Seiners	252	494	241	342	369	748	331	283	596	987
- Drum Seiners	165	613	374	423	458	725	323	433	718	1179
TOTAL ANNUAL GROSS TONNAGE										
- Table Seiners	595	595	595	511	437	349	291	291	329	295
- Drum Seiners	18	18	18	102	176	264	322	322	284	318
INDEX OF FOLLAR VALUE OF CATCH PER GROSS VESSEL TON										
- Table Seiners	8.4	16.6	8.1	10.7	11.0	21.4	9.1	7.7	16.3	26.7
- Drum Seiners	9.1	34.0	20.8	20.7	20.8	30.2	13.0	17.1	30.3	48.2
TOTAL NUMBER OF FISHERMEN										
- Table Seiners	120	120	120	96	77	59	45	43	47	42
--Drum Seiners	6	4	3	19	31	43	53	53	48	52
Aggregate	126	124	123	115	108	102	98	96	95	94

Source: Information supplied by a British Columbia fishing company.

seine boat catches for the period 1953-1962, demonstrates the almost continual success of drum seiners in the northern area of the Province. A comparison can be made between the catches that are landed by various table and drum seiners over a number of years. This provides a method of checking the boats against themselves and competitors. Almost consistently drum seiners have proved more efficient.

The table is based on a sample of seining fishing vessels in the norther area of the Province. The sample has been constructed from the records of a fishing company which employed these and other vessels. The sample is based on the operation of vessels owned both by the fishing company and by independent but associated fishermen. The sample includes no new boats constructed during this period nor the records of vessels which failed to fish continually. Certain of the figures, representing the index of the dollar value of catch, are unusually low for some vessels in specific years. Enquiry has shown this to be due to a variety of reasons such as incompetent skippers, breakdowns and failure to fish the entire season. Human failure on the part of the skipper appears to be the most frequent cause of low yields.

The time period examined is ten years. These years are significant as they cover the period during which the conversion of table seiners to drum seiners and the introduction of the power block took place. An examination of the table reveals that the vessels of lower tonnage were the first to be converted

to the drum seine. The length of the vessels is omitted to hinder identification but it suffices to indicate that the trend is similar. In 1953, all vessels in the sample had six-man crews. This included drum seiners as well as table seiners. The first power block was introduced on the latter in 1957 and it was a notable factor in reducing the size of the crews. By 1962, of the 21 vessels in the sample, all of whom originally had six-man crews, only two vessels were still in this category, both being table seiners. One vessel, originally a table seiner, was converted to a drum seiner only to change back after two years.

Table 2 demonstrates the greater efficiency of the drum over the table seine method of fishing. In most years the drum seiners outfished their counterparts by a healthy margin. The total value of the catch for each category of seiner was calculated annually, as was the average catch per vessel for each category. This latter average was calculated by dividing the total value of the catch by the number of vessels fishing. It is deceiving as it weights each boat equally regardless of size. To counteract this, it was decided to examine the dollar value of catch per gross vessel ton. This measurement bears some relationship to the cost involved in constructing each specific vessel and is a legitimate standard for measurement. An examination of the two indices of dollar value of catch per gross vessel ton demonstrates that in all years the rate of return per gross ton was higher for the drum seine rather than the

table seine category. This divergence is one of no small degree for, in some instances, the rate of return for a gross vessel ton of a drum seiner is twice that for table seiners. This difference is more noticeable in the early years when smaller vessels were in the drum seine category, and it declines in later years when larger and less easily convertible vessels are introduced. Another partial explanation for the reduction in this divergence is the introduction of the power block,a factor which came later into this area than in some others.

The owner of a table seine vessel has an incentive to convert due to the increased productivity that can be obtained by drum seiners. However, it is difficult to know whether the increased profit will cover the owner's cost of conversion, or whether it will generate sufficient revenue so as to make the alteration worthwhile from the vessel owners' point of view at least in the short-run. The answer to this fact is hidden by the index formulation of the table; a formulation which was considered necessary to hide the identity of the vessels. However, if the actual direct monetary return is not sufficient, there is still another major fact which exerts pressure on the owner to convert, i.e., the quality of the fishermen who operate the vessel. The good fishermen all prefer to work on drum seiners as their total individual remuneration is greater. In the long-run this fact alone may be a sufficient incentive to the vessel owner, for if he fails to convert, he will only be able to

attract the poorer fishermen.

The number of fishermen engaged on these 21 vessels has declined continually throughout the period from a high of 126 in 1953 to a low of 94 in 1962. The consequences of this decline are readily noticeable, both in the employment opportunities and in the rate of remuneration they provide per active worker. Fewer men are now employed on these vessels, but the total value of the landings by their effort shows a marked increase. Thus those fishermen who remain employed are now able to enjoy higher remuneration, as the 7/11ths of the net stock is divided amont fewer people. These fishermen have gained both from the increased productivity of the vessels and from the smaller sized crews. Those who are no longer required to operate these vessels have been forced to seek employment elsewhere, either in fishing or other occupations.

When new seine vessels are built, the drum seiner is, in fact, both a capital saving and labour saving innovation. The drum seiner, on the average, is a smaller and therefore a less costly counterpart to the table seiner. The drum seiners do not have to be as large or as powerful boats, as they only have to accommodate a five-man crew. This factor alone would appear to imply that the newer purse seine vessels would all be drum seiners, but this is not the case because of the inefficiency of drum seiners in some fishing areas. The implementation of the power block has reduced the need for the large sized table seiners, and these also will be reduced in size in future vessels.

Innovations have reduced the amount of capital required for salmon seine boats by reducing the necessary size of the vessel. However, the smaller sized vessel is at a disadvantage when it is engaged in other uses, such as halibut fishing or herring packing, since it lacks storage capacity. As more and more seine boats are utilized in other fisheries, convertability between fisheries becomes important and there is an increased tendency to retain the larger sized boat.

The construction of new drum seine vessels would not be opposed by either capital or labour, since all those directly involved would benefit. This construction, however, has to await profitable investment opportunities since the conversion of the existing fleet may postpone the day of need. However, if the conversion had a cost of $10,000 and a depreciation life of ten years, the total payments that would have to be made to capital per year would be $1,000 plus the interest charges on the debt outstanding. To meet these new expenses the value of the increased catch would have to increase, due to the share system, by approximately $3,000 per year. The average value per yearly catch for the typical table seine vessel is better than $10,000 a year. Thus the $3,000 figure appears to have been met, since the catches of drum seiners have increased to almost twice that of their table seine counterparts. This is a slightly illegitimate comparison since the two sets of figures are partially dependent on one another.

TABLE SEINE, POWER BLOCK

The year 1955 witnessed the introduction of a new innovation to aid the table seiner. The power block was the idea of Mario Puretic and was first successfully tested on a tuna seine boat in 1954. The power block was first used commercially in British Columbia on July 12, 1955 in the Straits of Juan de Fuca, and by August 10, 1955 all 104 table seiners fishing the Straits were equipped. Power blocks come in varying sizes depending on the gear to be hauled.[11] The power block consisted of a sheave which was suspended from the boom. The net was drawn over a sheave which was power driven by means of a rope belt attached from it to a cathead. The weight of the net on the sheave was sufficient to provide the necessary traction. The original power blocks were very heavy and weighed as much as 500 pounds. The later models were made of aluminum and weighed approximately 200 pounds. These newer blocks were hydraulically driven and contain a gear reduction within the heads themselves. The utilization of a power block allowed the speed of the individual settings to be doubled. This allowed the vessels to increase their production and to reduce the amount of heavy labour required.

The power block can therefore be classified as a capital-using and labour saving innovation. The block was

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11 Schmidt, "Puretic Power Block and its Effects on Modern Purse Seining", pp. 400-413.

particularly effective in increasing the catches in the Straits area. The Sockeye Commission administrators have suggested that the power block increased the effectiveness of the vessels by 15 percent.[12] Other individual fishermen have given higher estimates of around 26 percent, at least for the salmon seiners in the Straits of Juan de Fuca and along the West Coast. The International Pacific Salmon Commission, following tests covering an equal number of fishing days in 1955 and 1959, concluded that the seine gear fishing in the Straits during this period had increased in efficiency by 31 percent. The only major change in gear during this period was the introduction of the power block.[13] The cost of a power block varies, depending on whether it is to be solely for salmon or for herring as well. As block that is used for the former may cost $2,300 to $2,400 while power blocks for the latter may cost $4,000. On the average, most appear to cost $3,200 to $3,300 and have a usable life expectancy of from six to seven years. For example, if a power block cost $3,200 and lasted seven years, the annual depreciation would be $457. For the capital ist operating under the share system to obtain $457 per year would require that the net stock increase by $1,256 per annum.

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12 The Pacific Fisherman Year Book, Seattle, Washington, Miller-Freeman Publications, 1956, p. 118.

13 Sinclair, Licence Limitation, p. 213.

Most vessel owners appear to feel that the power block has increased their catches by a sufficient amount to have made it worthwhile for them to have installed the power block. Due to the share system, this would require an increase in the value of net stock of between $1,000 and $1,500 per year.

TRAPS

The salmon trap is probably one of the most effective and efficient methods of capturing fish. Fish traps can be constructed both as permanent or temporary structures. A fish trap usually consists of a long leader connected to a heart or core in the middle of the stream. The leader usually extends from the shore at the narrow entrance to an inlet or a channel. The leader is so constructed that the fish are prevented from passing through it, over it or under it. Instead, the fish will be forced to seek a way around the obstacle and, by instinct, they will swim alongside the net towards the centre of the channel. The centre or heart of the trap leads the fish into a small area from which they are brailed into packers and taken to the cannery. A trap which extended across a river mouth would be able to capture almost all the fish returning to spawn.

Salmon traps would also be a more efficient method of capturing salmon in that they would require a smaller quantity of labour and capital to capture a given quantity of fish. An innovation such as this would, at first glance, appear to be the only logical method of utilizing and economizing on scarce

factor inputs, but this has not been the case, and traps have not been used successfully or without heavy criticism.[14]

It is quite important to know why fish traps have failed and why they have been opposed by fishermen and other groups. Fishing traps were first operated in British Columbia in 1904.[15] There were not very many traps, and those which did exist were not on the rivers themselves but were mainly on the inlets and channels leading to the spawning grounds. They were not constructed in such a manner as to block off the entire channel but were frequently limited to closing half the passage. As a consequence of this, it was often felt necessary to construct a number of traps in a row. Fisheries regulations imposed by federal regulatory bodies limited both the length of the traps and the distance between them. These regulations were imposed on the grounds that they were necessary to ensure a sufficient escapement of salmon for spawning to perpetuate the species. A major problem with the traps was the non-selectivity of their operations which resulted in their frequently catching unwanted species of fish.

Traps were operative in British Columbia until 1956,

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14 The use of fish traps by American companies on the United States side of Juan de Fuca Straits was a sore point in Canadian-American relations for many years and contributed pressure towards international control of the fisheries.

15 W.A. Carrothers, The British Columbia Fisheries, Toronto, Toronto University Press, 1941, p. 17.

when the last one, owned and operated under a royal charter by the J.H. Todd Company, ceased operations at Sooke, B.C. The structures at Sooke were of the fixed type. The major reason for ceasing operationg given at the time for their closure was the high cost of maintenance and repairing the structures as compared to their yield. This seems to contradict the statement made as to the efficiency of traps, and therefore will need to be explained. The dominant factors in determining the catch of these Sooke traps were (a) the climatic conditions and (b) the prevalence of other gear. The increase in the number of fishing vessels operating in the vicinity of the traps grew remarkably during the 1950's. In the early 1950's there were approximately 70 purse seiners; by 1953, this number had increased to 80, and by 1956 there were about 110 seiners in the Straits of Juan de Fuca. Gillnet vessels also invaded the area, and they increased from 5 to 150 between the 1953 and the 1954 seasons. This latter total had risen to approximately 500 by 1962.[16] The implementation of the so-called Tatooch-Bonilla line between Tatooch Island and Bonilla Point, Vancouver Island, in 1956 also increased the concentration of vessels in the Straits of Juan de Fuca. Fishermen were not permitted to fish to the west of this line. Crowding has increased to such proportions in this area that vessels have to

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16 Estimates supplied by Mr. J. MacEacheren, a long-time British Columbia fisherman and associate of the United Fishermen and Allied Workers Union.

line up and take turns in setting their nets.

A distinctive feature about the operations of fishing traps is the lack of the share system. The traps operated in British Columbia illustrate a fishing technique in which no incentive or risk is involved on the part of the labour employed. The workers on the fishing traps were, in fact, paid straight wages without any share arrangements. The lack of a share system, and the decreased employment opportunities with the utilization of traps, helps to explain the opposition of fishermen to their operation.

The complaints of purse seiners over the operation of traps led to the appointment of a Royal Commission, which submitted its report in 1940. The Commission noted that traps had various advantages and disadvantages. From the point of view of conserving fish runs, they "... are subject to a more quickly effective regulation then other types of gear."[17] This finding does not appear to have found official recognition, as fish traps are still held to be illegal by regulatory authorities.[18]

On the otherhhand, fish traps in the past have been based on a property right or a privileged right to operate a

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17 Royal Commission Report relating to the use of (1) Trap-nets at Sooke Area and (2) Purse seines in a Portion of the Gulf of Georgia (Area No. 17) in Salmon Fishing in British Columbia, Ottawa, H.M.P.O., 1940, p. 9.

18 Norman Hacking, "Costly Strikes have Often Paid Off", The Province, Vancouver, August 12, 1963, p. 21.

trap. The location of the trap, and the right to sole utilization of a particular area is of prime importance. Too many traps in operation along a river would lead to a problem similar to that presently seen with too many boats. The successful operation of a fish trap depends upon private property rights on the location of the trap but also private property rights to the fish which utilize the river upon which the trap is located. For, unless there are private property rights to the fish as well as to the land, other fishermen could continue to exploit and deplete the stock of fish before they reached a particular trap. For fish traps to operate efficiently there must be strict control over other types of fishing gear. The operation of a fish trap therefore implies to some degree a monopoly right to exploit a particular group of fish. This monopoly right would have to be conferred either in perpetuity or on a long lease, else the monopolist would find it profitable to exhaust the fishery before it reverted back to its former owner, and there would be little incentive for him to invest in the growth of the fish stocks. This point was noted earlier in relation to agriculture while dealing with the history of the share system.

Fish traps are a possible solution to the overcrowded conditions of the British Columbia salmon fishery, and yet they offer no remuneration to those who would be displaced by their implementation. Thus it is the group of individuals who would suffer the economic loss that are most vocal in their opposition

to fish traps. If the implementation of fish traps were able to generate sufficient revenue to meet all necessary expenses and to give sufficient compensation to satisfy all those individuals who were displaced, then the change to fish traps should be implemented. It is not necessary that the payments be actually made to the displaced fishermen in order to increase the total welfare. If this were the case, economic efficiency and increased economic welfare suggest that fish traps would be the most effective way of reaping the sea's harvest. The actual decision on this controversial question ultimately will be settled in the political sphere by the government who is the landlord.

The innovations which have been examined in this chapter appear to show that the share system has not been of particular importance in hindering innovation. Innovations appear to have taken place at a rapid pace and to be, in general, both capital and labour saving. The reason for this high rate of innovation seems to lie outside the share system. A possible explanation for this is to be found in the following chapter which deals with the theory of a common property resource.

Chapter V

The Common Property Resource and Conservation

The salmon fishery of British Columbia is based upon a genus of fish that migrates from fresh to salt water. It is difficult to distinguish the salmon of each river system while they are at sea since all are relatively intermingled. This factor excludes the possibility of dealing with each river separately and, as a consequence, the whole British Columbia salmon area must be considered as a single geographic region.[1] The only time it would be possible to deal with a single river would be if fishing were permitted solely at the mouth of rivers or upstream.

While considerating the British Columbia coast region as an economic unit, it is imperative to decide as to the optimum degree to which it should be utilized; this may readily be stated so as to maximize the net economic yield, i.e. the difference between total cost and total value of production. In an agricultural example, the production function would be assumed to display diminishing returns as units of the variable factor were expanded upon a particular area of land. So likewise is the case of the British Columbia fishing industry which,

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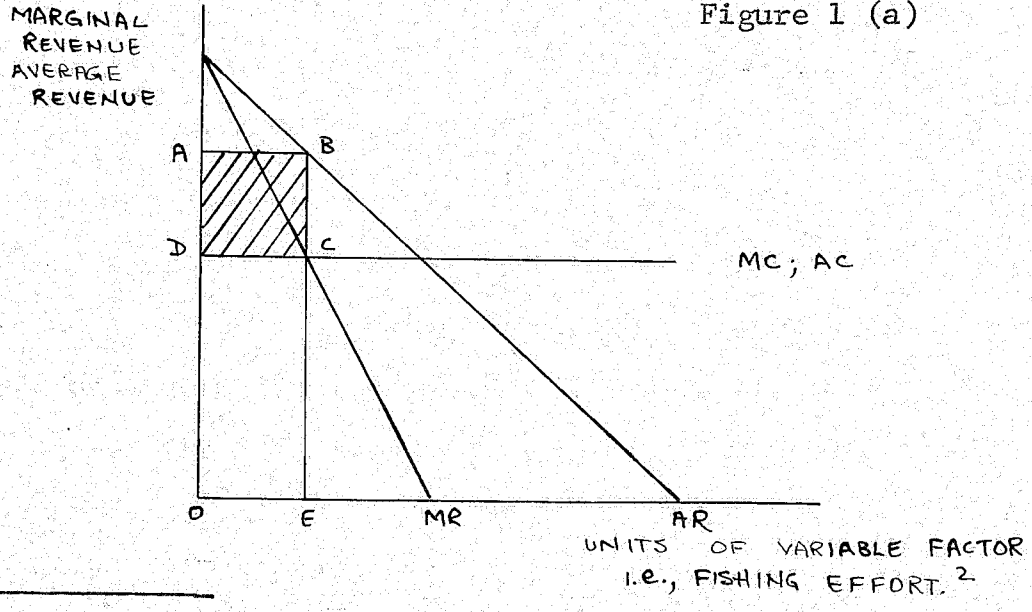
1 In fact, not only British Columbia waters but also the waters off the Washington coast must be considered as a unit, a factor which led to the formation of the International Pacific Salmon Fisheries Commission.

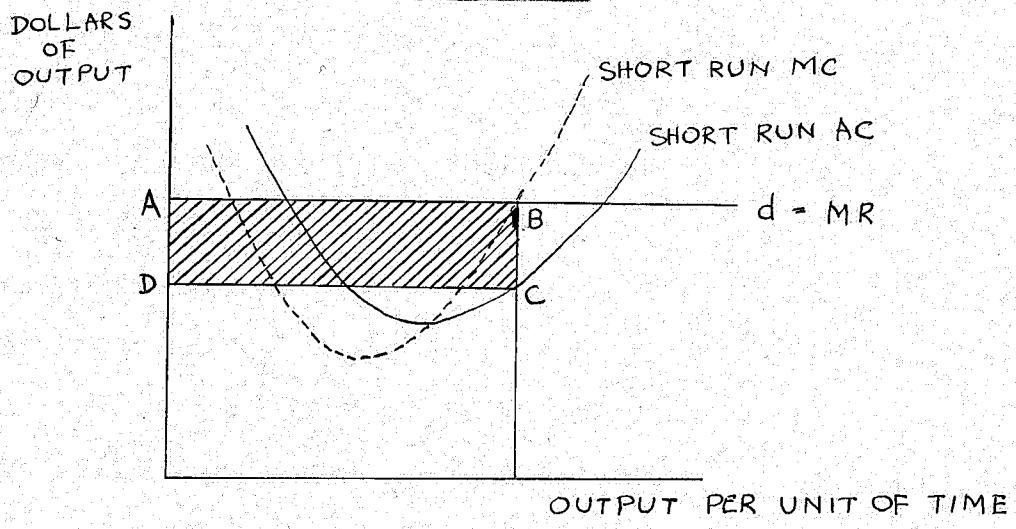
at least in the short-run, experiences increasing costs on the part of individual fishermen as they attempt to increase their landings. The increased effort required for larger landings comes in the form of higher variable costs. Money labour costs rise only as a fixed proportion to output due to the rigid effect of the share system, and therefore are not a factor leading to diminishing returns in the short-run unless higher product prices are necessarily paid for increased production. This may not appear to be as apparent if we examine the whole fleet as it now operates, but if there was a single owner directing the whole fleet it would become noticeable if he attempted to increase production with the existing capacity. Each boat under a situation such as this would equate marginal cost with marginal revenue and maximize its quasi-rent, i.e., ABCD.

Figure 1 (a)



2 Fishing Effort - Doses of Labour and Capital applied to fishing. Area ABCD = Quasi-rent.

Figure 1 (b)



The marginal and average revenue curves are based on the marginal and average productivity curves of units of fishing effort, where fishing effort is defined as the variable factor composed of combined doses of labour and capital applied to the fishery. These revenue curves assume there are no fixed costs and that the opportunity costs of the variable factor have been included. The fishery has yielded an economic rent which is equivalent to that found on intramarginal land at the intensive margin of cultivation. The rent in the case of the fishery is due to the productivity of the fishing ground and/or its location and is based on short-run considerations. This represents the optimum economic yield for this use.

So far the model of the fishing industry is similar to that of most agriculture farmed under the English system of tenure, but if resources are held under common ownership, such as in the case of a sea fishery, then there are certain

necessary modifications.[3] If the fishermen do not have property rights to specific salmon areas they will fish wherever they please and in so doing they will dissipate the rent of intramarginal grounds among all fishermen through competition. If the fishery has fishing grounds of varying qualities then the total possible rent from each ground will differ. There will be some grounds which are intramarginal and which will yield, under a secure tenure, a specific rent to the owner; likewise, there will be some fishing grounds which are marginal operations. The product from these latter grounds will only suffice to pay the opportunity costs of the variable factors. The optimum allocation of factors of production between these two fishing areas would be achieved when the marginal product from both grounds were equal, i.e., under the equimarginal principle.

The marginal physical products of each fishing ground will be equated. This can be seen in the diagrammatic example which follows on the next page. It is assumed that there is only one species of fish caught and that the fishing grounds

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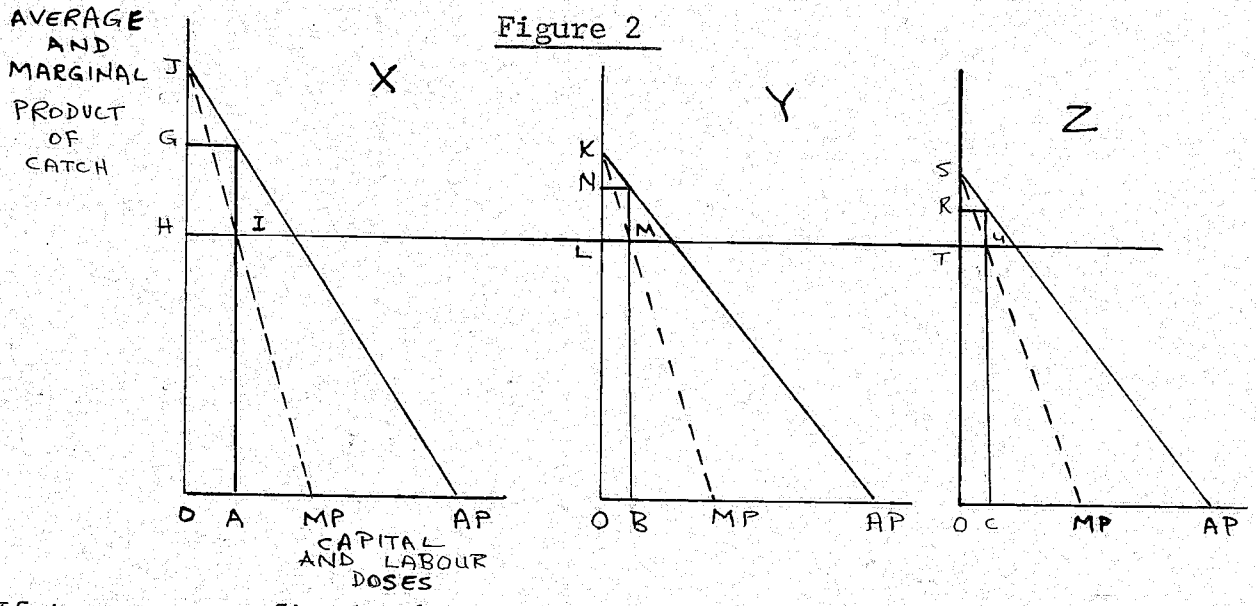
3 For further information on this topic see: J.A. Crutchfield, "Common Property Resources and Factor Allocation", Canadian Journal of Economics and Political Science, Vol. XXII, No. 3, (August 1956), pp. 292-300; Scott H. Gordon, "The Economic Theory of a Common-Property Resource: The Fishery", Journal of Political Economy, Vol. LXII, No. 2, (April 1954), pp. 124-142, and "An Economic Approach to the Optimum Utilization of Fishery Resources", Journal of the Fisheries Research Board of Canada, Vol. X, 1953, pp. 442-457; also, Anthony Scott, "The Fishery: The Objectives of Sole Ownership", Journal of Political Economy, Vol. LXIII, No. 2, (April 1955), pp. 116-124.

are of equal size. The rent that is present is partially due to the differing qualities of the grounds and partially to their scarcity.

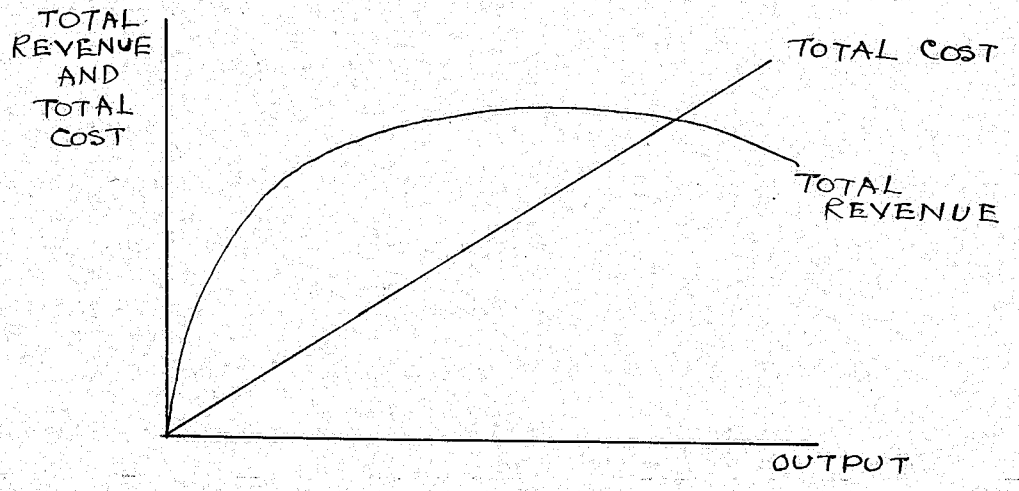
Figure 2



If tenure were fixed, the optimum situation would be to allocate OA, OB and OC units of the variable factor to fishing grounds X, Y and Z respectively. If, as is the case, the fishery is a common property resource, the variable factor would be dealt with differently. Fishermen are concerned with marginal product when deciding to maximize total profit but in making a decision regarding individual trips they allocate time according to the average product of individual fishing grounds. The average product on fishing ground X is GO, on ground Y is NO, and on ground Z, RO. These average products are not equal, therefore from the individual fisherman's point of view, it is more realistic to increase the time on ground X rather than fishing ground Z. This behaviour will continue

until the average products and not the marginal products are equal among fishing grounds, and only then will the situation be stable. To achieve an equality of average productivities among grounds would result in the exploitation of some fishing areas even when the marginal productivity of doing so is negative. This negative marginal productivity will lead to an increase in cost, so that the average cost will be equal on all grounds and the rent of the intra-marginal grounds will all be removed to meet the increased expenses. Total cost and total revenue will be equated as shown in Figure 3.

Figure 3



The British Columbia salmon industry falls into the category of a common property resource, and it had undergone conditions similar to those to be expected from the above theory. It is difficult to be too specific as the salmon fishery is not based on a small and limited fishing ground as are some demersal fish such as halibut, but rather encompasses the whole British Columbia coast. Salmon fishing does have

some characteristics similar to those to be expected from theory and though there is no specific ground there are specific areas which will normally have high returns at various times of the year. This is particularly true of certain passages, straits, inlets and river mouths where the fleet is densely located due to the large runs which must pass through these areas. The high density of vessels may be such as to prohibit the proper usage of gear and men effectively. The Straits of Juan de Fuca are a prime example, and have in approximate terms experienced a rapid growth in fishing effort both by seine vessels and by gillnetters, the latter having grown from approximately five vessels in 1953 to 500 by 1961. The increase in the number of seine vessels was nowhere near as large but they also did increase. The congestion due to the multitude of gear is so intense in this area that boats have to line up and wait their turn before they can set their nets.

The Federal Department of Fisheries has the responsibility of ensuring the continuation of the various kinds of fish along the British Columbia coast. The Department attempts to implement this policy by regulating the methods by which, and the times at which, fish may be caught commercially. Regulations have been introduced to limit or prohibit the effectiveness of various types of gear. Some regulations have limited the depth, length and place of nets, while others have prohibited the use of tangle nets and traps. The use of power driven skiffs

on purse seine vessels was also prohibited at one time. The Department has divided the British Columbia coast into various fisheries areas, each of which is then controlled so as to allow a sufficient escapement to perpetuate the species in the rivers and streams of the area. The escapement is assured by the implementation of a system of closed areas. Areas are closed to fishing for a number of days per week during the season. If the fishing fleet is particularly large or effective within an area, it soon manages to catch the permitted total of fish. The Fisheries Department is then forced to increase the length of the closed period. Thus an increased fleet results in fishermen and vessels being idle for longer periods of time. The factor that has attracted these vessels has been the economic rent which the fisheries could yield, but which the increased numbers have dissipated among themselves.

Chapter VI

A Review of Capital Utilization and Remuneration

Chapter V explained some reasons for the increased amount of capital used in the British Columbia fisheries. This chapter examines the growth that has taken place in this capital. The primary fishing industry employs many factors to produce the total product of the industry. In the examination of the share system these were broken down into two distinct groups, capital and labour. This and the next chapter will examine these two groups in the context of the total primary fishing industry of British Columbia. Before so doing, it is necessary to have some ideas about the magnitude and variations in the factors of production during the period under study.

CAPITAL INVESTMENT

Capital investment in primary fishing is mainly in vessels and gear. Fishing vessels have increased both in number and in value since 1952, but the most significant factors are to be found in the changing size and composition of the fishing fleet. Table 3 on the following page illustrates this changing pattern. During the eleven year period of 1952-1962, the number of boats in the category "over-10-tons" increased from 913 to 1210 or by 32 percent and their value increased from $24,279,000 to $31,879,000 or by 30 percent. Likewise, those in the category

Table 3

Number and Value of Boats in the British Columbia Fishing Fleet
1952 - 1962

Year	Over 10 tons		Under 10 tons		Total	
	Number	Value ($000)	Number	Value ($000)	Number	Value ($000)
1952	913	24,279	7,381	17,695	8,294	41,974
1953	887	24,488	7,584	18,888	8,471	43,376
1954	915	24,740	7,535	18,116	8,450	42,856
1955	950	25,424	7,244	18,142	8,192	43,566
1956	959	25,590	7,034	17,553	7,993	43,143
1957	985	26,766	6,881	17,923	7,866	44,689
1958	1,002	27,025	7,175	18,306	8,177	45,331
1959	1,015	27,253	7,463	19,600	8,468	46,853
1960	1,048	27,935	7,575	21,666	8,623	48,601
1961	1,184	30,144	7,672	23,659	8,856	53,803
1962	1,210	31,879	7,933	26,032	9,143	57,911

Source: Canada, Department of Fisheries, Fisheries Statistics of British Columbia, 1952-1962.

"under-10-tons" showed some significant changes. The number of vessels fluctuated from year to year but over the entire period their numbers increased from 7,381 to 7,933 or by 7.4 percent. The total value of vessels in this category also increased from $17,695,000 to $26,032,000 or a gain of 47 percent during this period, thus representing a significant change in the relationship of small vessels as part of the total capital investment in fishing. This change is all the more significant since the 1957 value is lower than that of 1952 and most of the growth has occurred since this latter date. Thus, in summary, the aggregate fishing fleet has increased in numbers by 10 percent and by value by 37 percent.

The fishing vessels in the "over-10-tons" group are either powered by diesel or by gasoline engines. The number, tonnage and value of these boats are given in Table 4 which follows on the next page. An examination of vessels in the "over-10-tons" grouping shows the following: (a) that the majority of these boats are diesel-operated (77 percent are in 1962 but the group of gasoline-powered vessels is growing at a faster rate than that of the diesel-powered vessels); and (b) that the average tonnage of vessels in the "over-10-tons" category has decreased both for diesel-powered vessels, which in 1962 averaged 27.1 tons, and for gasoline-powered vessels which averaged 11.2 tons. In 1952, the corresponding tonnage figures were 28.2 tons and 14 tons respectively. The average tonnage per vessel was highest for gasoline-powered boats in 1956 when it was 14.1 tons.

Table 4

Inventory of Fishing Boats in British Columbia,
10 tons and over, by type of engine,
1952 - 1962

	Diesel			Gasoline					
Year	Number of Boats	Tons	Value ($000)	Number of Boats	Tons	Value ($000)	Total Boats	Total Tons	Total Value ($000)
1952	738	20,866	21,784	175	2,466	2,495	913	23,332	24,279
1953	718	20,729	22,006	169	2,466	2,482	887	23,192	24,488
1954	734	21,350	22,112	181	2,681	2,628	915	24,031	24,740
1955	766	22,584	22,918	184	2,503	2,506	950	25,087	25,424
1956	774	22,931	23,006	185	2,652	2,584	959	25,583	25,590
1957	790	23,532	24,056	195	2,750	2,688	985	26,282	26,744
1958	804	23,726	24,383	198	2,759	2,642	1,002	26,485	27,025
1959	805	23,605	24,491	210	2,895	2,762	1,015	26,500	27,253
1960	843	24,075	25,593	205	2,415	2,342	1,048	26,490	27,935
1961	901	25,029	26,976	283	3,290	3,168	1,184	28,319	30,144
1962	936	26,419	28,829	274	3,193	3,050	1,210	29,612	31,879

Source: Canada, Department of Fisheries, Fisheries Statistics of British Columbia, 1952-1962.

The highest average tonnage per diesel vessel was in 1957 when it averaged 29.8 tons. This change in the average tonnage of the vessels is reflected in the average investment per vessel. The average value of diesel-powered vessels has increased from $29,517 in 1952 to $30,790 in 1962, but for gasoline-powered vessels it has fallen from $14,275 to $11,135. These figures are in terms of current dollars and if they were deflated, the average value per vessel in real terms would have decreased for both diesel and gasoline vessels. The decreased vessel size can be partially attributed to the introduction of labour and capital saving techniques such as the power drum and power block.

It is interesting to note the growth in the number of these larger vessels and to examine the categories into which it has been concentrated. This is illustrated by Table 5. Over the eleven year period, 1952-1962, the number of seiners increased by only 3 percent, packers by only 6 percent, longliners [1] by 68 percent and collectors by 54 percent. The major growth has taken place in the number of multipurpose boats. The number of seiner packers increased by 64 percent, while the number of seiner longliners and longliner packers increased by 406 and 230 percent respectively. The category "other" increased by 42 percent. The annual rates of growth have not

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1 Longliners are used for halibut fishing.

Table 5

Inventory By Type of Fishing Vessels, 10 tons and over, Engaged in British Columbia Fisheries, 1952 - 1962

Type of Boat	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962
Seiner	307	289	294	313	288	257	257	258	258	310	316
Packer	144	146	145	146	148	134	136	135	128	152	154
Longliner	41	67	57	50	56	36	34	33	31	71	69
Collector	50	39	41	45	44	35	37	43	47	72	77
Seiner-Packer	37	46	65	61	62	57	57	57	54	60	61
Seiner-Longliner	15	19	26	28	48	39	40	40	42	63	61
Longliner-Packer	20	21	27	42	44	40	40	39	40	46	46
Other	299	260	260	265	269	387	401	410	448	410	427
Total	913	887	915	950	959	985	1002	1015	1048	1184	1210

Source: Canada, Department of Fisheries, Fisheries Statistics of British Columbia, 1952-1962.

been constant in the various vessel categories throughout this period.

More than ever before the larger salmon seining vessels are now also engaged in the halibut fishery at least part of the year. It is not difficult to assess the reason for this as the salmon fishery is only feasible for a limited period of time and if vessels are not utilized in other occupations they must lie idle. The combination vessel is designed so as to be adaptable to a number of uses and therefore utilized for a longer period of time annually. It has been suggested that combination vessels, due to the adaptability of their design, are less efficient than they might be if they were specialized. The smaller salmon purse seiners,for example, may have a higher value of catch per unit of operating cost than do the larger purse seiners. This high value of catch per unit of operating cost is only obtained during a short salmon fishing season while during the remainder of the year the boat is forced to remain idle. The overhead or fixed costs of the small seiner can only be charged to salmon fishing while the larger seiners can charge their overhead costs partially to other fisheries.

The category "under-10-tons" can be further classified into boats of over and under 20 feet. The type, number and value of such vessels are examined in Tables 6 and 7. The most numerous category is that containing vessels under 10 tons but over 20 feet. The number of gillnetters in this category during the period under observation fluctuated from a high of 3,714 in

Table 6

Inventory of Fishing Boats Under 10 tons in British Columbia,
By Size and Type of Boats,
1952 - 1962

	Over 20 feet				Under 20 feet		
Year	Gillnet	Troll	Combination	Collector	Gillnet	Troll	Other
1952	3,714	1,582	292	178	114	1,116	384
1953	3,654	1,608	279	131	112	1,378	422
1954	3,607	1,441	289	158	76	1,483	481
1955	3,413	1,414	289	160	94	1,223	651
1956	3,359	1,390	270	151	101	1,166	588
1957	3,324	1,386	261	117	169	1,055	452
1958	3,169	1,444	317	120	259	1,382	484
1959	3,307	1,420	344	128	251	1,353	660
1960	3,174	1,598	403	127	271	1,363	639
1961	3,240	1,571	407	128	265	1,348	713
1962	3,425	1,570	550	145	376	1,252	715

Source: Canada, Department of Fisheries, Fisheries Statistics of British Columbia, 1952-1962.

Table 7

Value of Fishing Boats Under 10 tons in British Columbia,
By Size and Type of Boats,
1952 - 1962
($000)

	Over 20 feet				Under 20 feet		
Year	Gillnet	Troll	Combination	Collector	Gillnet	Troll	Other
1952	9,447	5,768	986	897	41	359	187
1953	12,145	6,120	1,049	746	14	349	107
1954	11,019	5,134	974	855	34	387	176
1955	9,417	8,084	1,111	838	30	361	134
1956	10,038	5,095	1,021	797	36	334	132
1957	10,486	5,274	1,982	621	63	325	204
1958	10,254	5,473	1,077	653	121	398	231
1959	10,758	5,736	1,381	734	116	495	380
1960	11,005	7,298	1,518	823	134	516	372
1961	12,872	7,141	1,802	857	137	506	344
1962	13,828	7,749	2,263	1,080	222	479	411

Source: Canada, Department of Fisheries, Fisheries Statistics of British Columbia, 1952-1962.

1952 to a low of 3,169 in 1958 or by 17 percent. The total number of gillnetter vessels declined during the eleven-year period by only 8 percent to a total of 3,429 in 1962. The number of trollers fluctuated similarly by 16 percent but they suffered a net decline of only one percent. The high and low years for trollers were 1953 and 1956 respectively. As was noted earlier in regards to vessels in the "over-10-tons" category, the real change was in the number of combination boats. In the "under-10-tons"and over 20 feet category, combination boats increased by 88 percent between 1952 and 1962. The years 1958, 1960 and 1962 were high growth years for such vessels; for example, the growth rate in this category was 35 percent between 1961 and 1962. In summary, it can be said that the fishing fleet in the "under-10-tons over 20 feet" category is diversifying its operations into more branches of fishing. The larger trollers and gillnetters are being adapted to enable them to salmon seine part time and to be used for halibut fishing.

The category of vessels under 10 tons and less than 20 feet has had the fastest rate of growth of any type of vessels solely engaged in salmon fishing. These boats are mainly gasoline or row boats operating in sheltered bays and, in particular, the mouth of the Fraser River. The number of small gillnetters has had the fastest rate of increase since 1952. These vessels increased in number from 114 in 1952 to 376 in 1962 or by 330 percent. Trollers, likewise, have experienced a increase though they only increased from 1,116 in 1952 to 1,252

in 1962. Trollers are still the most numerous of the small-type fishing vessels.

The average value per fishing boat in the "under-10 tons" category operated in British Columbia during the eleven year period has increased fairly substantially. The 1952 and 1962 average values were as follows:

Over 20 feet Under 10 tons

	1952	1962
Gillnetters	$2,544	$4,037
Trollers	3,646	4,936
Combination	3,377	4,115
Collectors	5,039	7,421

Under 20 feet Under 10 tons

Gillnetter	$ 360	$ 590
Troller	322	383

These values are indicative of the increased investment required for multi-purpose boats.

In summary of the entire fishing fleet, it can be said that more and more frequently the larger fishing vessels are being built to engage in fishing for other species of fish as well as salmon. The vessels that are engaged more specifically in salmon fishing are becoming smaller in size due, at least partially, to the progressive shortening of the fishing season. There is an increasing emphasis on vessels which are very small and operated by a crew of one or two men. These are the vessels which utilized the share system the least and which are operated by men whose regular full-time occupation is other

than fishing. Another notable fact is the increase in the number of fishing vessels falling into the category "other". It appears that fisheries other than salmon and halibut are being exploited to a greater degree than ever before. The actual number of vessels fishing each year varies depending on the expectations of the particular year's fishing opportunities. Old vessels may be reconditioned and new ones may be built when there are expectations of good catches. The construction of new vessels, however, appears rather to be related either to long-run expectations or to the ready availability of cash following a successful fishing season. The number and type of fishing vessels constructed in British Columbia between the years 1951-1952 and 1960-1961 are given in Table 8.

GEAR

The quantity of gear used in the British Columbia fishing industry has increased since 1952 in the salmon gillnet and salmon purse seine categories, though there has been a decrease in number of salmon troll lines and salmon drag seines. The number of skates of halibut gear has also declined. These facts are illustrated in Table 9.

The number of gillnets used has increased by 29 percent while their total value increased by 40 percent during this period. The average value of gillnets was $344 in 1952, and this had risen to $371 in 1962. This represents an 8 percent increase in the average value per net but also a decline in real

Table 8

The number and Type of New Boats Built in British Columbia By Types, 1951 - 1961

Year	Gillnet	Troll	Table Seiner and Combination	Drum Seiner	Longliner and Combination	Other	Total
1951-52	242	17	12	7	1	7	286
1952-53	82	17	12	3	1	5	120
1953-54	25	11	1	-	-	2	39
1954-55	50	12	8	1	2	4	77
1955-56	49	4	5	6	2	6	72
1956-57	42	11	6	1	2	1	65
1957-58	53	7	11	4	-	1	66
1958-59	80	25	1	2	1	2	111
1959-60	102	28	4	3	2	21[a]	160
1960-61	94	33	b	-	c	24[d]	155

a - 9 are gillnet combination and 3 troller combination.
b + c = 4 in total.
d - 18 are gillnet combination and 6 troller combination.

Source: Information supplied by the Department of Fisheries of Canada, Vancouver, B.C.

Table 9

Inventory of Gear in the British Columbia Salmon and Halibut Fisheries, 1952 - 1962
(Value in $ Million)

	Gillnet		Purse Seine		Drag Seine		Hand and Troll Lines		Skates	
Year	Number	Value	Number	Value	Number	Value	Number	Value	Number	Value
1952	7,437	2.6	483	1.6	13	.005	14,875	.30	9,516	.35
1953	7,211	2.6	463	1.4	11	.004	14,154	.39	9,334	.42
1954	6,535	2.4	467	1.4	8	.003	14,288	.37	8,474	.41
1955	6,647	2.5	504	1.7	8	.003	13,686	.30	9,082	.37
1956	7,014	2.6	499	1.4	6	.003	13,984	.34	8,804	.36
1957	7,416	2.6	503	1.4	8	.010	14,018	.34	10,014	.46
1958	7,562	2.7	518	1.5	5	.003	13,646	.36	10,392	.48
1959	7,436	2.4	516	1.5	16	.007	13,100	.45	8,683	.39
1960	8,022	2.7	509	1.6	13	.013	13,429	.42	8,721	.40
1961	8,010	2.9	500	1.9	8	.006	13,451	.45	8,747	.41
1962	9,652	3.6	499	2.0	8	.011	12,732	.44	8,736	.43

Source: Canada, Department of Fisheries, Fisheries Statistics of British Columbia, 1952-1962.

terms. The relatively small increase in the cost of gillnets is quite surprising considering that much of the changeover from linen to nylon nets took place during this period. The number of salmon purse seines showed an 11 percent degree of variability over the period, and reached a peak total in 1958. They have continued to fall in numbers since then. The average value per net changed from $3,229 in 1952 to $4,034 in 1962. This represents an increase in price of 24 percent. Drag seines, on the average, also increased in value. The number of troll lines has dropped continually, but there has been a steady change in the type of material used. Wire lines have now taken a dominant place in the industry. Cotton alone accounted for 41 percent of all lines in 1952, while the total for cotton and nylon combined represented only 12.7 percent in 1962. The total investment in salmon gear increased from $4,414,000 in 1952 to $6,077,000 in 1962. This represents a substantial increase of 37.6 percent.

ANALYSIS

The investment which has taken place during the last eleven years does not appear to have been warranted if one considers the actual conditions of the industry as of 1952. The post-war period was one of rapid expansion in the existing fishing fleet. This was an expansion rate which reached its peak during the years 1951-1952. The fishing capacity of the fleet had been expanded considerably by that time and yet expansion has continued until the present. What has warranted

this growth? Expansion would have been necessary if the then existing fleet was either unable to catch the total allowable catch or was able to do so but only at a higher cost than necessary. This higher cost would be operative due to the expansion in the use of the vessel beyond its optimum or most profitable output. This does not appear to have been the case as the number of days fishing allowed has decreased in most areas of the province during the entire period. Capital equipment has been used in the salmon fishery for shorter and shorter periods of time each year. This would not be so bad if the landed quantity of salmon had continued to increase, but in fact, the total landings per year of salmon have declined since 1952. A four year average for the years 1951-1954, 1955-1958, 1959-1962 showed 181,407, 143,145 and 119,997 million pounds respectively. This represents a decline of approximately 33 percent in the landed salmon weight over the period. Thus, in terms of salmon landings, the increased value of the fleet has not led to an increase in the total landings. The decline in the quantity landed was recompensed to some degree by the increase in the landed value. The average value of salmon landings for the years 1951-1954, 1955-1958, 1959-1962 was $23,594,000, $23,962,000 and $23,903,000 respectively, the last representing a 1.2 percent increase over the first. But still, in terms of the total salmon yield,there does not appear to have been a need for further investment. The figures above are related salmon catches alone. However, if the values of other

species of fish are examined they disclose the following. The average value of total fish landings in British Columbia for the years 1951-1954, 1955-1958 and 1959-1962 were respectively as follows: $34,405,000, $36,934,000 and $37,044,000. The last representing a 7.6 percent increase over the first. These figures suggest that the increase in fishing capacity may not have been warranted if we can assume that the existing fleet in 1952 was only making a competitive profit, i.e., obtaining solely its opportunity cost. If the fleet in 1952 was suffering from under capacity and high average cost, or, alternatively, an unusually high rate of return on the total investment, then it might be justifiable to increase its capacity.

If it is assumed that 5 percent is a satisfactory rate of return on capital investment in the fishing industry, this would represent a rate of return in 1951-1954 of $2,098,000 and in 1959-1962 of $2,825,000. A five percent rate of return is probably too low considering the variability and uncertainty from year to year and the rate of return that could be earned on capital invested in comparable enterprises. All this aside, even if it is assumed that 5 percent is a sufficient return to capital, then during the period 1951-1954, 8.8 percent of the average annual salmon catch would have been required to meet this expense. By 1959-1962, a similar 5 percent rate of return on capital invested in the fishing fleet would have required 11,8 percent of the annual salmon landings. If instead, the rate of return is considered as a percentage of the average

value of all species of fish landed, then, 5.09 percent of this value would have been necessary in the years 1951-1954 and 7.6 percent in the years 1959-1962 to pay the rate of return on investment.

The investment in the primary fishing industry is large and has grown at a faster rate than the increase in average yearly catch. During the 1951-1954 period, the value of capital invested in the primary fishing fleet was equivalent to 177 percent of the annual value of the salmon catch, and this had grown to 242 percent by 1959-1962. In other words, the total value of salmon landed during the former period would have required 1.77 years to meet the total capital investment, while the latter would have required 2.42 years. Once again the situation does not appear to be so serious if the total landed value of all fish is considered. In this case the total time required for repayment of the investment would be 1.23 years in 1951-1954 and 1.56 years in 1959-1962. The growth in the value of landings of other species of fish rather than salmon has reduced the apparent increase. There is, however, no real reason why in fact the average life of the capital investment may not have increased. There may have been a factor of capital deepening at work. This is certainly true in regards to the increased use of electronic equipment. A process of capital deepening can possibly explain, at least in part, the increased amounts of capital devoted to capturing salmon.

What has been the role of the share system during this

period of increased capital investment? In the earlier discussion of the share system and innovation, it was indicated that the share system hindered the rate of innovation by forcing the entrepreneur to demand that the value of the total product of his investment be at least 2.75 times his original cost. If an innovation did not have a yield of this magnitude the entrepreneur would not implement it. The same criterion which applied to innovations can be applied to investment in the salmon seine fleet. This criterion implies that the share system will under-allocate capital to the fishing fleet. However, if the share system has a restraining effect on the rate of capital investment in the fishing industry it is not easily noted. In fact, the vessels which operate at least partially in branches of the fishing industry which use the share system, notably salmon and herring seining and halibut longlining, are among those which have increased in numbers at the fastest rate between 1951-1961.

There are a number of possible explanations as to why the share system is not having the effect that was to be expected. The first explanation is to be found in the common property nature of the British Columbia sea fisheries. This common property feature, as was noted in Chapter V, encourages the use of more vessels than would be utilized if the fisheries were exploited as a private property. The second reason for the increased number of boats is the regulation of the fisheries which has led to a shortened fishing season and a need to capture as many fish

as possible as soon as possible after the season opens. The shortened fishing season for the various individual species has led to the increase in the number of multi-purpose boats and to an increased need for fishermen to man these vessels.

Chapter VII

A Review of Employment

The innovations and changes in capital investment discussed in the preceeding chapter have had important effects on the demands for labour and the composition and work habits of the labour force engaged in the fishing industry. The fishing regulations imposed by the Federal Department of Fisheries and the International Pacific Salmon Commission have tended to foster an increase in the number of people going fishing by their regulations which (a) stimulate the capture of as many fish as possible, as quickly as possible, and (b) prohibit the use of most effective gear, for example, monofilament nets. Fishermen, as noted in the introduction, are a highly diverse and complex group. It is difficult to define what actually constitutes a commercial fisherman. The first prerequisite, of course, is that he possesses a license to fish commercially. Yet many people who have commercial fishermen's licenses, in fact, are not truly engaged in fishing to any large extent. Some people buy commercial fishing licenses with no intention of really engaging in selling their catch but rather to enable them as individuals to exceed their limit as sports fishermen, although since 1955 the regulations have required all licensees to sign an affidavit that they are catching fish that are to be sold. Other individuals have been known to take out licenses in the hope of avoiding taxes on their boats which are really pleasure crafts. This is illegal since boats to be exempt

are to be used solely for commercial fishing. Fish packers, for instance, are not exempt from the sales tax, as they are considered to be a type of storage facilities. The hope of avoiding the five percent social services tax gives some incentive for individuals to claim that they are commercial fishermen since the latter are exempt from social services tax for all equipment that is used in commercial fishing, and much of this can be used for purposes other than fishing. Another reason for individuals claiming to be commercial fishermen when in fact they are not is in the discounts they can obtain as fishermen for gear and parts.

The best figures that are available on employment are relatively recent. In 1953 the Department of Fisheries began to examine the number and nature of the fishing licenses sold. Their procedure presents some difficulty as not all fishermen are required to take out licenses and some fishermen are engaged in fishing for more than one species of fish. The information provided gives some indication of the changing patterns in the fishing industry. Since 1953 the number of licensees, that is people holding at least one license, has increased as follows:[1]

Year	No. of Licensees	Year	No. of Licensees
1953	12,008	1958	14,266
1954	12,680	1959	14,463
1955	11,860	1960	14,191
1956	10,853	1961	15,660
1957	12,016		

1 Canada, Department of Fisheries, Fisheries Statistics of British Columbia, 1961, Ottawa, Queen's Printer, 1962, Table 8.

Even if a four year moving average is applied to smooth out the cyclical variation from year to year, the increase in the number of fishermen between 1953 and 1961 amounts to 25.6 percent. A four year moving average gives the following result:

Year	Total	Yearly Average
1953-1956	47,401	11,850
1954-1957	47,409	11,852
1955-1958	48,995	12,249
1956-1959	52,598	13,149
1957-1960	55,936	13,984
1958-1961	59,580	14,890

Further examination of licensees also discloses another important fact; the number of individuals holding more than one license has increased each year as is shown on the following table:[2]

Year	One License Only	Two Licenses	Three or more	Total
1953	9,844	1,904	260	12,008
1954	9,885	2,397	398	12,680
1955	8,643	2,552	665	11,860
1956	8,219	2,167	467	10,853
1957	8,819	2,556	641	12,016
1958	10,486	2,992	788	14,266
1959	10,896	2,816	751	14,463
1960	10,577	2,771	843	14,191
1961	11,533	3,240	887	15,660

This is a significant change and represents a movement into multi-license holdings by some fishermen, and in part accounts for the increased catch of other species. This movement into other

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2 Canada, Department of Fisheries, Commercial Fishing Licenses, British Columbia, 1961, Vancouver, 1962, Table 6.

fisheries is due in part to a need by the fishermen to earn more income to cover their higher investments, and to utilize the capital investment in the vessel more efficiently. The shorter fishing season for most species due to the larger numbers fishing and to the improved equipment used has accentuated this movement. The three groups of license holders represented on the above table experienced varying rates of increase between 1953 and 1961. The one license only group increased by 17 percent, those with two licenses by 70.1 percent and those with three or more licenses by 341 percent. Though multi-license holding increased rapidly, it represented only 26.3 percent of the total licensed fishermen in 1961. Probably the most striking phenomenon is the change in the composition of the types of fishermen making up each group. During the nine year period, the number of fishermen in each license category varied, but this does not appear to have affected the development of some noticeable trends. The license categories of fishermen are as follows: gillnet, troll, captain salmon purse seine, assistant salmon purse seine, halibut, captain herring purse seine, assistant herring, and others. In the group containing single license holders all major categories showed gains except two; captain salmon purse seine and assistant salmon purse seine showed declines. However, if the numbers of salmon purse seine captains and assistants are examined in the two and three license groups, there is a notable increase. In brief, it appears that captains and crew members on salmon seiners turned to other

fisheries, particularly herring, to supplement their incomes. The majority of salmon purse seine captains who held two licenses were engaged either as captains or assistants on herring vessels. Halibut fishing also is showing a greater appeal than formerly to these seine captains, and it is this fishery which has seen the greatest expansion in recent years. The salmon purse seine assistants have usually held a variety of other licenses. For many, their second license was either for trolling or for herring seining, but in recent years the former has decreased slightly, and herring has also shown a slight decline if examined with a four year moving average. The greatest growth, as is to be expected from the above examination of seine captains, has been in halibut and other fisheries.

The most pronounced change was in the number of fishermen holding three or more licenses. The number of purse seine captains in this category increased rapidly, but it is the number of salmon purse seine assistants who also hold herring and halibut licenses that has increased most rapidly.

Having a commercial fishermen's license does not necessarily mean that the holder actually engages in fishing the type of gear listed on his license, particularly if he holds more than one license. This problem was mentioned earlier. It continues to exist and is an inherent part of the statistics which cannot be easily excluded. It is a factor which limits the usefulness of any measure of employment in the fisheries by means of licenses.

When dealing with employment, it is possible to measure the total of those working during a particular period of time, but in the fisheries, in particular, it is also useful to know the rate of turnover among fishermen. Fishermen along the British Columbia coast appear at first glance to be a relatively transient group in terms of their mobility into and out of the industry. An analysis by the Federal Department of Fisheries of the 1961 licensees notes that only 23.4 percent or 3,668 fishermen of the total 15,660 individuals fishing had actually fished during each of the nine years in which the survey of licensees was conducted.[3] Of all the 1961 licensees, a total of 43.1 percent had held licenses for between 6, 7, 8 and 9 years, while in the same year, 24 percent of the total number of licensees were in their first year as license holders. A most noticeable fact concerning all the years surveyed was the large number of fishermen holding licenses for the first time. The following statistics show the annual number of new licensees entering the fishing industry for the first time:[4]

Year	Number	Percentage of Yearly Total Licensees
1954	2,235	17.6
1955	2,392	20.2
1956	1,775	16.4
1957	2,303	19.2
1958	3,673	25.7
1959	3,843	26.6
1960	3,036	21.4
1961	3,754	24.0

3 Commercial Fishing Licensees, British Columbia, 1961, Table 2.

4 Ibid., 1960, 1961, Table 3.

It seems that recruitment into the fishing industry occurs at a relatively fast rate, and there is no shortage of individuals wishing to go fishing commercially, at least for the first time. This high rate of recruitment of first year fishermen is a major factor in maintaining the growth in the number of fishermen engaged in the industry. Though the industry grew at a rapid rate throughout this period, it has not increased to the degree that it would at first appear. Recruitment into the industry has been exceedingly high, but so indeed has been the number of departures shown for the years 1957-1961 in the table below:[5]

Year	No. Failing To Renew	Percent of Yearly Total Licenses
1957	2,528	23.0
1958	3,943	32.8
1959	4,696	32.9
1960	4,380	30.3
1961	3,770	26.6

In the above years, approximately 29.1 percent of the fishermen licensed in each of the previous year failed to renew their licenses. The year 1958 is particularly noticeable as this is the year of the large Adam's River run, a factor which has been suggested as being responsible for the high rate of recruitment, yet even in this year, 32.8 percent of the individuals fishing

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5 Commercial Fishing Licenses of British Columbia, 1960, 1961, Table 4.

in 1957 failed to renew their licenses. The rate of turnover appears to be high. This could be a factor in leading to high costs in an industry which prides itself on the need for a high degree of skill to ensure success. The Canadian Department of Fisheries in 1960 examined the level of experience of those fishermen who engaged in fishing over a period, 1953-1960. The survey results which are produced below in Table 10 suggest that there is a hard core of individuals who continue to fish virtually every year and that there is a large floating group who remain from one to three years. This survey notes that of the 32,057 individuals who had held licenses for at least one year during this period, a total of 10,455 had purchased licenses in only a single year. This group of single-year license holders does not include those who purchased licenses in 1960. Therefore, almost a third of those individuals who bought licenses held them for a single year only, and appear to constitute by far the greatest number of those fishermen leaving the industry annually.

A noteworthy fact is the distribution of experienced fishermen among the various fisheries districts.[6] District 2 had the highest relative percentage of experienced fishermen in 1960. District 3, on the other hand, in 1960 had the highest

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6 There are three districts in all along the coast. District 1 is confined to small areas around Greater Vancouver and District 3 is comprised of all other fishing areas to the south of Cape Caution, a point just north of Vanrouver; it also includes both the east and west coast of Vancouver Island and Juan de Fuca Straits. District 2 encompasses all areas north of Cape Caution.

Table 10

Number of Licensees in Each District by Years - 1953-1960

	Dist 1	Dist 2	Dist 3	Total	Percent of Total
In all 8 years, 1953-1960	1,833	737	1,425	3,995	12.5
In 7 years including 1960	617	333	464	1,414	4.4
In 6 years including 1960	342	201	369	912	2.8
In 5 years including 1960	290	169	345	804	2.5
In 4 years including 1960	376	161	450	987	3.1
In 3 years including 1960	448	145	667	1,260	3.9
In 2 years including 1960 and 1 other	172	62	206	440	1.4
In 1959 and 1960	455	186	702	1,343	4.2
In 1 year 1960	1,279	320	1,437	3,036	9.5
Sub-Total 1960 Licenses	5,812	2,314	6,065	14,191	44.3
In 7 years but not 1960	133	72	146	351	1.1
In 6 years but not 1960	212	122	200	534	1.7
In 5 years but not 1960	267	154	312	733	2.3
In 4 years but not 1960	382	162	376	920	2.9
In 3 years but not 1960	623	266	675	1,564	4.9
In 2 years but not 1960	1,418	436	1,455	3,309	10.3
In 1 year but not 1960	4,283	1,030	5,142	10,455	32.5
Sub-Total Other Years	7,318	2,242	8,306	17,866	55.7
Grand Total	13,130	4,556	14,371	32,057	100.0
Percentage of Total	41.0	14.2	44.8	100.0	

Source: Canada, Department of Fisheries, Commercial Fishing Licenses, British Columbia, 1960, Vancouver, 1961, Table 1.

percentage of inexperienced fishermen, and throughout the period of the survey, from 1953 to 1960 inclusive, has had the highest rate of turnover or the highest number of individuals who have held licenses for only a single year.

The category of fishermen engaged in salmon fishing who appear to spend but a single year in the fishery are usually trollers and salmon purse seine assistants and/or a combination of such licnesees as is shown in Table 11 below:

Table 11

Type and Percentage Failing to Renew Their Licenses in Selected Years, 1957, 1959, 1960 and 1961

	1957	1959	1960	1961
Gillnet and/or Combination	15.2	30.9	23.1	19.7
Captain salmon and/or Comb.	6.3	10.2	5.7	6.2
Troll and/or Combination	24.9	40.4	24.9	32.2
Asst. salmon and/or Comb.	25.9	30.6	27.9	28.1
Halibut only	45.4	21.0	39.3	29.3
Other		29.8	56.8	36.8
Average Percentage	23.3	32.9	30.3	26.6

Source: Canada, Department of Fisheries, Commercial Fishing Licenses, British Columbia, 1957, 1959, 1960 and 1961, Vancouver, Table 4d.

However, the group of fishermen holding only halibut licenses, or who fall into the category of "other" licenses, have in recent years had a poor rate of renewal. The salmon purse seine captains appear to be the most stable category, as is probably to be expected as they are frequently committed to the industry

more or less permanently due to their ownership of large fishing vessels, or to purchashing such vessels on a long-term basis. The salmon purse seine captains appear in most cases to be in the higher earning group of fishermen. This will be noted later when the earnings of various types of gear are examined.

The rate of turnover among districts for fishermen using different gear also varies, but it appears to bear a close relationship to the quantity of the particular type of gear in the district. The following table shows the number of licensees and their license holdings by district in 1961:[7]

	Dist 1	Dist 2	Dist 3	Total
Salmon Gillnet	2,683	724	518	2,925
Salmon Gillnet and Combination	927	319	472	1,718
Captain Salmon Purse Seine	54	55	77	186
Captain Salmon Purse Seine and Combination	145	55	71	271
Salmon Troll	969	440	3,302	4,711
Salmon Troll and Combination	160	133	881	1,174
Assistant Salmon Purse Seine	526	296	672	1,494
Halibut Only	183	165	52	399
One Other not Salmon	414	82	322	818
Other Combination not Salmom	71	30	18	119
Total	6,704	2,419	6,537	15,660
Percentage	42.8	15.5	41.7	100

Salmon gillnet is the most important type of license in Districts 1 and 2 though the number of gillnet licences in District 2 is only approximately one-third of the District 1 total. Trolling

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7 Commercial Fishing Licenses of British Columbia, 1961, Table 5b.

licenses are by far the most popular type of license in District 3 and this district accounts for approximately three quarters of them. Captain salmon purse seine licenses are most important in District 1, followed by Districts 3 and 2 respectively. However, District 2, which usually accounts for approximately 15 percent of the total licenses issued, is well represented in seine licenses. District 1 accounts for the largest number of captain salmon purse seine and combination licenses and it appears that individuals from District 1 fall into the category of those who are most likely to engage in other fisheries. This may be accounted for by the fact that fishermen from this region are possibly more aware of their opportunity income elsewhere.

Chapter VIII

Fishermen's Incomes

The two previous chapters have dealt with the employment of resources in the fishing industry, but there is still one major sector that has to be examined, that is, the rate of remuneration these factors have received. These have been reviewed in terms of some individual projects and some individualsvessels. This still does not answer the question as to how the salmon fishing industry is faring in the aggregate, for it is important to know the remuneration that is being achieved per unit of effort by the various segments of the industry. The income of fishermen as individuals appears to show great variability between high and low extremes. There are numerous factors which may account for this, and the share system is but one among many. Earlier in Chapter II there was a discussion of the reasons for the presence of the share system in the fishing industry, and of the fact that the monetary consequences of failure were partially shifted to fishermen. It was noted that this risk-bearing function was certain to have some effects on fishermen's earnings, depending on their propensity to accept the consequences of failure. It has been suggested that most fishermen are willing to accept this risk-bearing function and do not impose a price for doing so. Whether this is in fact true has not been tested but the truth of this statement depends upon both the collective and individual attitudes towards

gambling and the possible chances of obtaining abnormally high incomes.

The problems of determining a fisherman's income are, however, more inclusive than solely determining a fisherman's attitude to risk-bearing. What are the constituents of a fisherman's income?

Fishermen receive part of their income as a share payment for the work they perform while engaged on the vessel. Fishermen also receive windfall profits on capital that has been invested by the vessel owner, as a constituent of fishermen's incomes. These profits may be due to the fortunate invention and implementation of an innovation or new technique. These profits are basically a windfall gain, since the fishermen have not been required to invest in the new innovation, and yet they have been assured of a share in the increased productivity the innovation has yielded. Few occupations can offer their workers such a certainty of sharing in the increased productivity of the industry.

Though this is true, the share system has a particular effect on this segment of fishermen's income, since through its operation it may theoretically slow down the development and modernization of the industry and thereby the maintenance or growth of fishermen's incomes in comparison with labour incomes in other sectors of the economy. The reduced growth rate of the industry is a possible consequence of the share system's failure, on occasion, to allow a sufficient remuneration to capital.

Individual fishermen must be paid at least as much as the opportunity incomes they must forego by staying in the fishing industry. This is assuming that they are aware of other opportunities and are sufficiently mobile to take them up. If this is not the case, then fishermen will possibly have incomes lower than their opportunity incomes and will represent a mis-allocation of resources to the fishing industry which could be used more efficiently elsewhere. The prevalence of such a situation has been suggested as being possible because of the number of fishermen who continue to remain in the fishing industry while earning low annual incomes. It is also possible that some fishermen may be paid a wage higher than their next best opportunity, and that they may in fact be earning a quasi-rent on their services.

Gillnet, seine and troll fishing have accounted for varying percentages of the total catch over a number of years, but the results of the landings per average licensee have not yet been examined. The remainder of this chapter intends to determine the remuneration fishermen are really receiving and whether they are, in fact, receiving earnings which are equivalent to their opportunity costs. Before examining the various returns to the specific type of licensee, there will need to be some qualifications which will apply to all types of gear. The tables below list the salmon landings, by weight and value, of fishermen using each type of specific gear. This value is the total value for the entire catch, and includes the boats' shares.

The number of days fishing for salmon by each type of gear is also noted. This provides a good measure of the degree of effort required to land the specific catch. This figure is related to the number of boat days that were fished, and is not related to the number of fishermen per boat. The number of days fishing is not completely accurate in the case of troll boatssas these vessels sometimes fish for more than one species of fish on a specific day. The number of licenses issued presents some difficulties since a growing number of fishermen are holding more than one license. This difficulty in classification hassbeen overcome by setting up an ordering, or ranking, of those fishermen with more than one license. Any fishermen with a gillnet license has been placed in the gillnet category even though he may also seine part-time. Seine license holders who also hold troll licenses, or any other licenses except salmon gillnet, would for this analysis be classified under the seine category. The total of troll license holders will therefore not include those licensees who hold either salmon gillnet or salmon seine licenses in combination with a troll license. The tables also display the annual landings by weight and value per licensee. The resulting figures for gillnet and seine licenses appear relatively correct, but those for trollers appear to have been influenced greatly by the number of fishermen who have taken out commercial troll licenses and yet sell few fish commercially.

GILLNETTING (See Table 12 on next page)

Gillnet vessels have experienced decreasing landings of salmon by weight throughout the eleven-year period, but the decline in value has not been as severe. A noticeable trend throughout this period has been the decline in the number of days of actual fishing, and the increase that has occurred in the average daily landings. The latter has shown an upward trend though there were some particularly poor years, notably 1956 and 1960. The average daily return per gillnet vessel has also shown an increase. The above information has been related to the returns per unit of effort in the fishery, and not to the number of individuals among whom this reward has been divided.

In the previous chapter, the number of licensees engaged in fishing was examined but it is only now that the real significance of the increased number of fishermen can be truly seen. The annual catch per license has declined, particularly in terms of the weight landed but also in terms of the value. The annual value of landings per license has fluctuated between $2,636 and $1,696 per year over the eleven-year period. This average value has to remunerate the fisherman for the cost of the vessel as well as for his labour. N_o deductions have been made for fuel and other operating expenses. Such expenses as these were sampled in 1953 and 1954 by the Department of Fisheries. The results suggest that the average cash operating expenses of gillnet vessels drawn from a random sample were

Table 12

Gillnet Caught Salmon by Weight and Value in Relation to the Effort and Number of Fishermen Licensed, 1951 - 1961

Year	Landings (Million Pounds)	Value ($000)	Number of Days Fishing	Average Landings Per Day Lbs.	Average Return Per Day $	Number of Actual Licenses Issued	Yearly Landings Per Licensee, Lbs.	Yearly Value of Landings Per Licensee $
1951	81.66	13,070	235,682	346	55.45	5,635	14,492	2,319
1952	63.19	10,107	167,538	389	50.80	5,272	12,365	1,917
1953	76.64	10,161	204,826	374	49.60	5,203	14,730	1,952
1954	77.05	10,582	201,252	383	52.60	5,031	15,315	2,103
1955	52.20	7,396	165,061	316	44.80	4,361	11,970	1,696
1956	52.47	10,427	182,744	287	57.06	3,955	13,267	2,636
1957	57.79	7,830	128,171	451	61.57	4,466	12,940	1,753
1958	76.86	14,711	174,825	439.6	84.15	5,590	13,750	2,632
1959	45.91	8,851	138,985	330	63.68	5,064	9,066	1,748
1960	37.28	9,060	143,650	259.5	63.07	4,984	7,480	1,818
1961	56.03	12,950	128,171	437	101.04	5,840	9,594	2,217

Source: Blake Campbell and S.L. Young, An Analysis of Gross Returns from Fishing in British Columbia by type of Gear Licensed in 1961 Fishing Year; Also Canada, Department of Fisheries, British Columbia Catch Statistics, 1951-1961; Also unpublished information supplied by the Department of Fisheries of Canada.

$1,422 in 1953 and $1,366 in 1954.[1] These expenses have increased slightly in conjunction with the general increase in prices since this survey. These costs would appear to show that the average rate of return per fisherman would not be large and that, in fact, in many cases the average fisherman appears to be only just covering his costs. This, however, is not completely true since some vessels are operated by more than one license holder, and the average return of two licenses should be compared with the operating costs. Other information on the cost of operating gillnet vessels in the Skeena River region indicate that the annual average operating expenditure per boat ranged between $1,500 and $2,000 during the 1953-1957 period.[2] This gross income per annum from salmon has been earned during an ever shortening season. In 1951 the average gillnet licensee fished 41.8 days, but by 1961 the season had been reduced to 21.9 days. This reduced fishing time has been brought about by increased closures during which commercial gillnetters are unable to fish.

TROLLING (See Table 13 on next page)

The aggregate catch of all trollers declined in weight over the eleven year period. This decline was, however, not reflected in the value of the catch which increased. The number of days fishing remained relatively constant reflecting somewhat

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1 D.R. Buchanan and B.A. Campbell, The Incomes of Salmon Fishermen in British Columbia, 1953-1954, Ottawa, Economics Service, Department of Fisheries of Canada, 1957, p. 44, Table 16.

2 Sinclair, License Limitation - British Columbia, p. 173.

Table 13

Troll Caught Salmon By Weight and Value in Relation to the Effort and Number of Fishermen Licensed, 1951 - 1961

Year	Landings (Million Pounds)	Value ($000)	Number of Days Fishing	Average Landings Per Day	Average Return Per Day $	Number of Actual Licensees Issued	Yearly Landings Per Licensee, Lbs.	Yearly Value of Landings Per Licensee $
1951	29.18	5,192	132,873	219	39.00	5,129	5,689	1,012
1952	27.78	4,058	120,405	213	31.11	5,272	5,269	770
1953	25.94	3,951	120,786	215	32.71	4,738	5,475	772
1954	20.34	3,802	109,110	186	34.84	4,580	4,441	856
1955	22.98	4,728	112,983	203	41.84	3,915	5,870	805
1956	22.98	5,751	107,349	214	53.57	3,561	6,453	891
1957	26.32	4,939	123,344	213	40.04	4,373	6,019	821
1958	26.54	6,853	132,849	200	51.58	5,512	4,815	1,243
1959	23.96	5,877	130,147	142	45.16	6,084	4,103	966
1960	16.24	5,256	132,120	123	39.78	6,165	2,634	853
1961	23.56	6,605	123,344	199	53.55	6,682	3,676	988

Source: Blake Campbell and S.L. Young, An Analysis of Gross Returns from Fishing in British Columbia by type of Gear Licensed in 1961 Fishing Year; Also Canada, Department of Fisheries, British Columbia Catch Statistics, 1951-1962; Also unpublished information supplied by the Department of Fisheries of Canada.

the lack of closures, as they are not applied to trollers. The year 1962 was one of particularly heavy fishing by this type of gear with 133,550 fishing days being recorded, the highest on record.[3] Average landings have fallen slightly throughout the period, but the average value per landing has increased slightly. The number of troll licensees has continued to increase in number and the yearly landings per licensee have declined both in weight and value. The average number of days fishing has also diminished from 25.9 days in 1951 to 18.4 days in 1961. This latter change can be explained almost exclusively by the increase in the number of part-time or evening fishermen who make only occasional deliveries. This was noted earlier when the increased number of small vessels was examined in detail. During 1961, the Federal Department of Fisheries examined the distribution of the troll catch among licensees. Their findings showed that 1,799 out of a total of 6,682 licensees failed to sell any fish and that 69.7 of the fishermen who made fish sales received less than $1,000.[4]

SEINING (See Table 14 on next page)

Salmon purse seine operators have experienced conditions quite similar to those experienced by gillnetters. The

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3 British Columbia Catch Statistics, 1962, p. 15.

4 B.A. Campbell and S.L. Young, An Analysis of Gross Returns From Fishing in British Columbia by Type of Gear Licensed 1961 Fishing Year, Ottawa, Economics Branch, Department of Fisheries, Table 10.

Table 14

Seine Caught Salmon By Weight and Value in Relation To the Effort and Number of Fishermen Licensed 1951 - 1961

Year	Landings (Million Pounds)	Value ($000)	Number of Days' Fishing	Average Landings Per Day Lbs.	Average Returns Per Day $	Number of Actual Licenses Issued			Yearly Landings Per Licenses Lbs.	Yearly Value of Landings Per Licensee $
						Assistant	Captain	Total		
1951	89.41	9,980	16,773	5,331	595	2,412	+ 510	2,922	30,599	3,415
1952	57.12	5,140	10,550	5,414	489	2,328	+ 465	2,893	19,744	1,775
1953	86.88	7,538	19,246	4,514	391	2,647	+ 481	3,128	27,774	2,777
1954	84.00	9,093	16,940	4,959	537	2,851	+ 525	3,406	24,662	2,670
1955	57.98	6,613	17,174	3,376	359	2,714	+ 540	3,254	17,818	1,893
1956	41.53	5,178	13,644	3,044	380	2,252	+ 489	2,728	15,157	1,889
1957	51.21	6,020	12,873	3,978	468	2,701	+ 516	3,217	15,919	1,871
1958	81.45	15,565	14,867	5,479	1,047	2,877	+ 518	3,395	23,991	4,585
1959	38.55	5,775	12,878	2,993	448	2,641	+ 515	3,156	12,215	1,830
1960	24.07	4,085	13,448	1,790	304	2,551	+ 496	3,047	7,900	1,341
1961	44.73	6,597	12,873	3,475	512	2,836	+ 489	3,325	13,453	1,984

Source: Blake Campbell and S.L. Young, An Analysis of Gross Returns From Fishing in British Columbia by Type of Gear Licensed in 1961 Fishing Year; also Canada, Department of Fisheries, British Columbia Catch Statistics, 1961-1961; also unpublished information supplied by the Department of Fisheries of Canada.

total seine catch appears to have shown a relative decline compared to that of gillnets, though this decline seems to have a cyclical movement. Seiners have been inethe high-catch vessel category during the peak sockeye years of 1950, 1954, 1958 and 1962. The decline in seine catches as a percentage of the total catch has been quite significant, though this downward trend has not been reflected as greatly in terms of the value of landings. The number of days fishing per vessel has declined, as has the average daily weight landed. The average daily return has remained relatively stable with only a small decline. The number of fishermen engaged in salmon seining has increased, though in terms of licenses issued there are both more trollers and more gillnetters. There has been a decline in the annual landings per licensee and in the annual value of such landings. The number of assistant purse seine licenses has increased at a faster rate than those for captains. This appears to be a rather odd phenomenon as many of the table purse seine vessels are being converted to drum seiners and therefore require smaller crews. A possible explanation may lie in the fact that with the increase in multiple license holding some individuals are obtaining assistant seine licenses to allow movement between various segments of the industry. Another possible reason for the increase in assistant seine licenses may be a fear of entry restrictions into this segment of the fishery after publication of the Sinclair Report. The increase in the number of combination vessels will also have had some

effect, particularly combination trollers and seiners which are classified solely under seine vessels in regard to the number of licenses. The number of days of salmon seine fishing per purse seiner has declined from 32.9 days in 1951 to 27.9 days in 1961. Both these years were noticeable for relatively high average daily catches.

The information which has been presented in Table 14 is difficient if one seeks to obtain the actual earnings which are equivalent to earnings in other enterprises. All the values given per licensee are in the gross form, i.e., no deductions have been made to cover the necessary expenses that have to be incurred to earn this income. For comparative purposes, it is best to have a net income per fishermen. The income or yearly value of landings per licensee is a difficult variable to examine and assess,particularly for seine fishermen. Earlier it was noted that purse seiners had varying sizes of crews, and that the total catch per vessel was divided among these members under the share agreement. The information given in Table 14 applies only to the gross earnings per crew man or licensee, and does not refer in anyway to the boat's share which must still be deducted from this total. If the operating expenses are ignored for the time being, then it is possible to derive the crews' share of the vessels average daily catch. This is accomplished by reducing the average returns per day 4/11ths, i.e., the boat's share. The yearly value per licensee excluding the boat's share may also be derived in a similar

manner. The results of these computations are shown in the following table:

Year	Average Crew's Return Per Day $	Yearly Value of Landings Per Licensee Excluding Boat's Share $
1951	378	2,175
1952	312	1,142
1953	249	1,768
1954	342	1,701
1955	228	1,206
1956	242	1,203
1957	298	1,192
1958	666	2,992
1959	285	1,166
1960	193	855
1961	326	1,265

Both of the above estimates are still in a gross form since no deduction has been made for the expenses incurred in obtaining this income. There are some deductions still to be made from the above though these do not appear to be too large. A method for deriving net income will be discussed later in the chapter.

To supplement the information on gross earnings that is derived in Table 14 and the table above, an attempt was made to secure a sample of fishing vessels listing the entire value of their catch during a ten year period. The sample consists of 31 vessels, the catches of which are recorded in Table 15. The sample, which is based on availability of data rather than

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Table 15

Annual Dollar Value of Salmon Seine Catch

Vessel Number	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	Annual Average Over 10 Years 1952 - 1961	Tonnage	No. of Captains during Period	Type of Vessel Date of Conversion
1	15,432	15,720	22,638	11,077	25,805	17,208	13,041	11,029	10,626	19,258	16,183	18	2	D (1955)
2	14,128	10,953	16,638	10,731	12,790	12,517	25,321	4,288	7,304	18,716	13,346	26	2	D (1961)
3	10,460	13,936	10,007	4,252	4,375	10,772	23,587	11,235	4,068	11,060	10,375	20	3	D (1961)
4	10,345	18,707	24,417	10,127	16,977	13,968	44,244	11,401	7,634	16,349	17,419	22	1	T
5	8,829	18,436	27,831	10,791	9,934	19,764	51,298	8,298	6,020	12,551	17,375	19	2	T
6	21,557	38,018	24,072	25,320	18,741	28,228	62,185	16,618	12,889	22,576	27,020	40	1	T
7	14,442	31,576	46,463	23,173	17,927	20,522	84,797	20,388	13,596	18,594	29,148	39	2	T
8	11,338	57,020	60,116	26,638	17,296	26,383	47,359	26,114	10,875	13,347	29,649	62	2	T
9	13,918	33,027	29,782	14,445	13,493	24,455	63,290	17,960	14,164	23,192	24,773	31	2	T
10	16,604	27,457	38,909	23,882	16,699	23,636	46,408	11,795	13,272	20,474	23,914	36	3	T
11	12,864	13,976	18,180	12,761	9,692	11,429	55,272	11,755	8,099	14,574	16,860	24	2	T
12	10,547	12,498	21,437	9,391	11,421	11,190	22,414	17,102	11,926	17,033	14,496	25	2	T
13	15,605	23,262	20,384	12,590	9,217	17,704	70,355	12,784	5,979	14,230	20,211	33	1	T
14	17,796	26,693	40,700	8,442	6,834	18,437	76,226	14,739	6,454	12,681	22,900	30	2	T
15	16,447	35,293	33,874	16,044	17,478	29,412	58,170	15,732	10,876	18,616	25,194	25	1	T
16	18,603	36,975	34,351	18,799	10,796	17,921	75,921	17,135	6,565	7,244	24,420	42	1	T
17	18,018	17,786	19,885	12,468	12,540	14,227	29,519	16,363	8,765	11,537	16,111	24	4	T
18	13,453	23,657	22,776	16,039	14,690	22,248	37,723	12,774	11,569	21,335	19,626	29	1	T
19	22,011	20,447	17,832	17,213	13,032	16,979	27,159	14,836	9,309	17,019	17,584	16	2	T
20	8,542	20,121	30,419	10,052	6,545	22,844	99,076	13,039	4,508	12,183	22,733	39	4	T
21	26,204	29,546	22,864	16,688	13,477	22,036	28,114	13,319	6,810	14,527	19,359	13	1	T
22	13,383	15,010	14,712	9,388	10,742	13,697	25,823	12,963	5,944	16,846	13,851	17	1	T
23	15,698	22,432	20,498	13,830	15,246	24,089	61,758	19,125	12,684	21,793	22,715	21	2	T
24	9,739	22,692	10,839	12,096	9,345	10,667	26,651	76,861	9,146	20,737	20,877	20	2	T
25	8,351	10,358	9,877	9,399	12,553	15,754	39,483	13,227	19,021	41,955	17,898	21	2	T
26	17,163	31,941	54,025	24,213	13,258	17,218	78,067	9,936	12,774	12,604	27,120	42	1	D (1959)
27	13,018	14,838	22,884	12,636	8,731	11,690	40,044	8,858	10,573	25,916	16,919	27	1	T
28	13,955	24,803	14,584	13,954	10,859	1,843	44,516	11,708	12,587	17,021	16,583	28	6	T
29	16,085	74,568	81,059	32,186	16,764	22,803	81,006	33,155	10,175	13,256	38,106	58	2	T
30	20,171	26,077	28,588	17,539	17,015	16,256	39,475	16,604	9,057	20,237	21,102	32	1	T
31	9,822	25,154	24,568	13,396	12,637	15,967	20,670	11,835	5,414	17,498	15,696	25	4	T
Average Annual Catch Per Sample Vessel	14,662	25,579	27,900	15,469	13,126	17,795	48,357	16,544	9,603	17,579				

Source: Information obtained from an examination of a fishing company's records.

a random selection, appears to show higher earnings than would be expected from the latter method. The major differences between this sample and a random sample are noted below.

An examination was made of the distribution of vessel tonnage for all seine vessels 10 tons or over during 1958. The distribution was as follows:

Tonnage	No. of Vessels	Percentage
10 - 19	150	35.7
20 - 29	117	27.8
30 - 39	60	14.0
40 - 49	27	6.2
50 - 59	24)	
60 - 69	23)	15.7
70 or over	19)	

The sample of 31 vessels has a slightly different distribution:

10 - 19	5	16.1
20 - 29	14	45.1
30 - 39	7	22.6
40 - 49	3	9.6
50 or over	2	6.4

Another major divergence is in the location in which fishing occurred. The majority of the vessels in the sample travel from area to area, though none represents the Straits of Juan de Fuca. The majority of vessels spent considerable time fishing the Department of Fisheries Areas 12 and 13, i.e., Johnson Straits. The vessels are almost exclusively table seiners, only four having been converted to drum seiners. The sample represented 31 vessels out of a possible total of 465

seine vessels in 1952. This is a slightly more than 6.6 percent of the vessels operating during this year. Eleven vessels had the same captain throughout the period, fourteen vessels had only two, and the rest had more than two. None of the vessels in this sample are included in the sample of 21 vessels dealt with earlier. The average annual value of catch has been calculated over the ten year period, 1952-1961. This value has not been deflated for price changes which have occurred in the later years. There appear to be some examples of large variation in yield for vessels of similar tonnage, but the coefficient of rank correlation between tonnage and average value of catch is .696. This coefficient of rank correlation is a significant correlation at a level of significance of 2 percent.

The operating expenses for fuel are difficult to ascertain as records were not available for annual consumption by these vessels. An estimate has had to be made based on the experiences of salmon seine fishermen who worked during 1953 and 1954 on the similar seine vessels. The estimated value of fuel and oil consumed by seine vessels was $968 and $814 per year for 1953 and 1954 respectively.[5] Further information on fuel consumption is also available in Table A-3 of The Incomes of Salmon Fishermen in British Columbia, 1953-1954 by Buchanan and Campbell. They estimated that the total fuel and oil costs of salmon assistants averaged $111 and $87 per year for 1953

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5 Buchanan and Campbell, Incomes of Salmon Fishermen, p. 65.

and 1954 respectively. These figures would,however, include the fuel and oil expenses of these fishermen when they also fished for species other than salmon. The range of those reporting fuel expenses was quite high varying between a low of $24 and a high of $355. The representative annual fuel expenses per vessel derived from the above figures would be $1,221 in 1953 and $957 in 1954.

The above two sets of information were to be the major checks on the accuracy of estimate for fuel expenses of vessels. The annual estimates of fuel expenses were calculated by an examination of the annual number of days fishing which occurred multiplied by an arbitrary constant. The constant figure was $25 per day as an average of diesel operation per seine boat. Such a figure is open to criticism as there is a wide variation around this point, but it appears to be fairly correct. This estimate was assumed to be constant through the entire period. If the improvements that have occurred in fuel and engine efficiency, and the reduced average size of seine vessels over the last ten years are weighed against increased fuel prices, the constancy appears close to reality.

To estimate the cost of operating these vessels, it was necessary to have some information on the number of days fishing that each vessel did per year. Not all such information was available. As a next best alternative, it was decided to estimate the number of days fishing that these vessels were likely to have done by assuming that they were a random sample

of the entire salmon seine fleet, and that information derived for the fleet about costs and the average number of days fishing per vessel would apply to this sample. Table 16 shows the average number of days fishing per vessel and the estimated total number of days the 31 sample vessels fished annually.

Table 16

Estimated Number of Fishing Days for 31 Seine Vessels

Year	Total Days Fished by Seine Vessels	No. of Captain Licenses	Average No. of Days Fished Per Vessel	Estimated No. of Days Fished by 31 Vessels
1952	10,550	465	22.7	704
1953	19,246	481	40.0	1,240
1954	16,940	525	32.2	998
1955	17,174	540	31.8	986
1956	13,644	489	27.9	865
1957	12,873	516	24.9	772
1958	14,867	518	28.7	890
1959	12,878	515	25.0	775
1960	13,448	496	29.0	899
1961	12,873	489	26.1	809

Source: Table 14.

The calculated estimates of costs are shown in Table 17 on the following page. These costs varied between $567 and $1,000 per year for salmon fishing operations of seine vessels and are within 3 precent of the 1953 and 1954 sample estimates made by the Department of Fisheries. The Department's figures for these years were $968 and $814 respectively.

Table 17

Annual Average Salmon Seine Expenses

Year	No. Days Fishing	Constant	Estimated Total Fuel and Oil Expenses $	No. of Captain Licenses	Average Annual Salmon Seine Expenses Per Boat $
1951	16,773	25	419,325	510	822
1952	10,550	25	253,750	465	567
1953	19,246	25	481,150	481	1,000
1954	16,940	25	423,500	525	807
1955	17,174	25	429,350	540	795
1956	13,644	25	341,100	489	698
1957	12,873	25	320,925	516	622
1958	13,867	25	371,675	518	718
1959	12,878	25	321,950	515	625
1960	13,448	25	336,200	496	678
1961	12,873	25	321,825	489	658
				Average	726

Source: Table 14.

Utilizing information obtained from the earlier tables an estimate was made of the annual remuneration of the fishermen working on the 31 sample vessels. This estimate is given in Table 18 on the following page. The Department of Fisheries 1953-1954 survey of fishermen's incomes disclosed that the average net income of crewmen on seiners over 55 feet was $2,059 in 1953 and $2,428 in 1954.[6] The average net income of all salmon purse seine assistants was $1,658 in 1957 and $3,674 in 1958.[7]

6 Buchanan and Campbell, Income of Salmon Fishermen, p. 65.

7 Canada, Department of Fisheries, B.A. Campbell, A Review of Fishing Earnings of Salmon and Halibut Fishermen in British Columbia, 1957 and 1958, Ottawa, Queen's Printer, 1960, p. 29.

Table 18

Estimated Annual Fishermen's Remuneration for 31 Sample Vessels

Year	AAverage Catch Per Vessel $	Total Estimated Expenses $	Estimated Value of Net Stock $	Average Return Pef Share	Estimate of Annual Return Per Fisherman on vessel with 6 men crew	Estimate of Annual Return Per Fisherman on Vessel with 5 men crew
1952	14,662	567	14,095	1,281	1,495	1,793
1953	25,579	1,000	24,579	2,234	2,606	3,128
1954	27,900	807	27,093	2,463	2,874	3,448
1955	15,469	795	14,674	1,334	1,556	1,868
1956	13,126	698	12,428	1,130	1,318	1,582
1957	17,795	622	17,173	1,561	1,821	2,185
1958	48,357	718	47,639	4,331	5,053	6,063
1959	16,544	625	15,919	1,447	1,688	2,026
1960	9,603	678	8,925	811	946	1,135
1961	17,579	658	16,921	1,529	1,784	2,141

Source: Tables 15 and 17.

The sample of 31 vessels appears to show higher earnings for the fishermen of these vessels than the estimate of earnings based on the Department of Fisheries figures. There may be a number of reasons for this and it was to some degree to be expected. The sample survey taken over the years by the Fisheries Department has noted the wide divergence which has occurred in both catch and earnings. Almost invariably 60 percent of the boats have caught only 40 percent of the catch while 40 percent of the boats have caught 60 percent of the catch. The fact that the estimates of fishermen's incomes based on this sample are higher than the expected average indicates a reason for the high annual rate of turnover. How many crew men, in fact, fished on these vessels each year is not known, but indications are that even in the early years there were less than seven men on some boats. In the later years, the average crew size on these vessels was probably close to 5 men. The Department of Fisheries has no estimate as to the number of men actually fishing on seine vessels during a fishing season. All commercial fishermen are required to buy a license but this does not necessarily mean that all licensees go fishing, nor that all licensees fished throughout the entire season. An estimate of the average crew's size can be derived from an examination of the number of licenses issued in comparison to the number of boats. On this basis, the average crew's size would be as indicated in Table 19 on the next page. The increase in 1961 may be due in part to the desire of some

prospective fishermen wishing to ensure themselves of a license following the recommendations on license limitations in the Sinclair Report. It is the writer's opinion that the 1956 figure of 5.5 is closer to being correct than the later ones.

Table 19

Estimated Seine Crew Size
1951 - 1961

Year	No. of Assistant Licenses (1)	No. of Captain Licenses (2)	Total Licenses (3)	(3) ÷ (2) Equals Estimated Crew Size
1951	2,412	510	2,922	5,72
1952	2,328	465	2,893	6.4
1953	2,647	481	3,128	6.5
1954	2,851	525	3,406	6.4
1955	2,714	540	3,254	6.0
1956	2,252	489	2,728	5.5
1957	2,701	516	3,217	6.2
1958	2,877	518	3,395	6.5
1959	2,641	515	3,156	6.1
1960	2,551	496	3,047	6.1
1961	2,836	489	3,325	6.7

Source: Table 14.

What are the daily earnings of salmon seine fishermen? An analysis of the Department of Fisheries information on the value of daily salmon seine fishing vessels allows for some indication of the earnings of salmon seine fishermen. The average daily earnings per seine vessel was noted earlier. If it is assumed that $25 is a correct average of the expenses

required for fuel and oil, it is possible to calculate an estimate of the average net daily return per fisherman. It is impossible to ascertain the exact number of men who are actually engaged in fishing salmon on seine vessels but some indication of the reduced number can be seen from an examination of the earlier example dealing with the conversion of vessels from the use of table seines to drum seines. As well as this, there has been the reduction in the size of the crew needed to operate table seiners due to the introduction of the power block. The number of crew members in the earlier example experienced a decline over a ten year period of 18 percent. In this earlier example, no vessel had a crew of over six persons in 1962. If it were assumed that this fact was fairly general throughout the industry it could readily be understood why wages per man day have increased. Estimated daily earnings of salmon seine licenses are shown in Table 20 on the following page. If in 1951 the average vessel had a crew of 7 men, then the average wages per day's fishing would be as in Table 20. If the average size of crew changed over the period from 7 to 5, then the new take home pay per worker would be higher, as in the last column of the table. In fact, there has been a change in the number of crew men per vessel. This change should have reduced the average vessel's complement to around 5 men and have increased the average take home pay per worker.

The average income of salmon purse seine fisherman is particularly high on a per diem basis, and this has been a factor

Table 20

Estimated Daily Earnings Per Salmon Seine Licensee, 1951 - 1961

Year	Average Catch Per Day Per Seine Vessel		Estimated Expenses		Average Value of Catch Per Vessel After Expenses	Crew's Share Including Food	Average Earnings Crew of 7	Average Earnings Crew of 5
1951	595	-	25	=	570	362.73	51.81	72.55
1952	489	-	25	=	464	295.27	42.21	59.05
1953	391	-	25	=	366	232.91	33.27	46.58
1954	537	-	25	=	512	325.82	46.55	65.16
1955	359	-	25	=	334	212.55	30.36	42.51
1956	380	-	25	=	355	225.91	32.27	45.18
1957	468	-	25	=	443	281.91	40.27	56.38
1958	1,047	-	25	=	1,022	650.36	92.91	130.07
1959	448	-	25	=	423	269.18	38.45	53.84
1960	304	-	25	=	279	177.55	25.36	35.51
1961	512	-	25	=	487	309.91	44.27	61.98

Source: Table 14.

in attracting men into the fishery. This high daily income is really an unrealistic measure, since fishermen do not earn high daily wages every day of the week. In fact, with the increased number of fishermen who have entered the industry, there have been shorter and shorter periods of fishing allowed. What is really significant is the annual earnings which can be obtained from fishing. The average annual earnings of salmon seine assistants have been particularly low compared to their opportunity incomes and this has been a factor in encouraging fishermen to participate in other fisheries at other times of the year. This may be a good thing if there is a sufficient supply of and demand for other types of fish.

How favourably does the remuneration of seine fishing compare with that obtainable in other occupations? To answer this question the income obtainable in other industries during the period of May 1 to October 31 was calculated for the years 1956-1960. The average weekly British Columbia wage in the respective industries was multiplied by the number of weeks. This period was chosen as being representative of the length of the salmon season. The estimated alternative opportunities are tabulated below:

	Income for the Period May 1 - October 31 $				
Industry	1956	1957	1958	1959	1960
Forestry	$2128	$2221	$2263	$2493	$2574
Construction	2113	2296	2198	2313	2451
Water Transportation	1766	1882	1957	2117	2277
Industrial Composite	1824	1919	1973	2082	2157

An examination of the net earnings of the crew members of the 31 sample vessels shows that even if it is assumed that these vessels had only 5 men crews their earnings would have been comparable with their alternatives only for two (1957-1958) out of the five years, 1956-1960. The Department of Fisheries estimated the net earnings per licensee during 1957 and 1958 to be $1,658 and $3,674 respectively.[9] Thus on the average they appear to compare favourably with the alternatives. The year 1958, however, was exceptional and it has not been repeated. In later years, annual salmon seine fishermen's incomes appear to have fallen behind their alternatives. The major difficulty with the above is that they hide quite a wide range of incomes. This variability could be due to a number of causes ranging from inefficiency on the part of the operators and scarcity of fish, to only a short period of fishing for some individuals. Some seine fishermen may only fish in a part-time capacity to supplement their income from other employments. This variability can be seen in the table below.[10] In 1957, of 2129 salmon purse seine assistants surveyed, 37.6 percent had gross earnings less than $1,000 and 67.5 percent had gross earnings less than $2,000 and yet 16.2 percent had incomes between $3,000 and $6,000. In

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8 Dominion Bureau of Statistics, Annual Review of Employment and Payrolls, 1960, Table 9.

9 Canada, Department of Fisheries, Campbell, Review of Fishing Earnings, p. 29.

10 Loc. cit.

1958, on the other hand, there was only 34.6 percent with gross earnings of less than $2,000.

Gross Income	1957 Percent of Fishermen	1958 Percent of Fishermen
Under - 999	37.6	20.9
1000 - 1999	29.9	13.7
2000 - 2999	13.8	14.5
3000 - 3999	8.2	11.5
4000 - 4999	5.4	10.0
5000 - 6999	3.7	12.4
7000 and over	.9	17.0
	100.0	100.0

A major cause of this variability in fishermen's incomes is the share system. The most important fact is that much of the variability is shifted, at least in part, to the seine fishermen through the share system. If a fishing vessel experiences a poor season, the cost of its failure is borne by all the crew as well as the owner of the vessel. The extent of this variability can be seen to some degree by an examination of the distribution of the gross value of landings by seine vessels during a number of years. This is shown on Table 21 below. A noticeable feature is that the variability does not appear to be as large in 1961 and in earlier years. D.R. Buchanan and B.A. Campbell in their 1953-1954 survey on incomes noted an even wider divergence in seine fishermen's incomes at that time.

The thought of making a "high pay packet" is a particular

Table 21

Comparison of Number and Distribution of Salmon Seiners
By Gross Return Groups for 1956, 1957 and 1961

Gross Return Per Boat Dollars	1956 Boats No.	1956 Boats Percent	1957 Boats No.	1957 Boats Percent	1958 Boats No.	1958 Boats Percent
Under 500	18	3.6	19	3.8	22	4.5
500 - 4,999	93	18.8	105	20.9	54	11.1
5,000 - 9,999	135	27.3	95	19.0	61	12.5
10,000 - 14,999	127	25.7	110	21.9	158	32.4
15,000 - 19,999	80	16.2	97	19.4	118	24.2
20,000 - 29,999	37	7.6	70	14.0	65	13.3
30,000 - 34,999	2	.4	2	.4	5	1.0
35,000 and more	2	.4	3	.6	5	1.0
Total	494	100.0	501	100.0	488	100.0

Source: Campbell and Young, Analysis of Gross Returns, 1961, Table 4, p. 8.

incentive to the inexperienced fishermen. Very high daily earnings in fishing due mainly to the efficiency of the fishing gear and the Department of Fisheries regulations gives a further definite incentive to enter the industry. The share system presents a possible opportunity of making a high income for relatively little work and little capital investment. The failure of many to obtain an income meeting their expectations must in part account for the high rate of turnover in the industry.

Before leaving this subject it is appropriate to make some comments on the earnings of capital invested in the seine fleet. No estimate is available as to the value of the entire fleet, but an unofficial estimate was obtained for those vessels in the 31 vessel sample. The total aggregate value was estimated to be approximately $1,209,000. The total average annual value of the salmon caught by these vessels was $641,543. The average expenses were calculated to be $29,723 per year. If this were the case then the total net stock for the vessels in the sample would be $611,820 annually. The boats' share of this was 4/11ths, 2 1/2 shares for the vessel and 1 1/2 for the net. 2 1/2 shares were equivalent to $138,822 per year, but from this must be deducted the captain's bonus leaving a total of $121,471 as the gross return to vessel owners in the sample. A 5 percent return on invested capital estimated at $1,209,000 would require $60,450 in interest payment. The figure of 5 percent is particularly low considering the risk and uncertainty that individual

vessel owners must face. There would also be some depreciation to be accounted for by the investment. This depreciation should be between 5 percent and 6 percent for the vessel hull and possibly 7 1/2 percent, or as high as 10 percent, for the engine depending on its style. Other equipment, e.g. electronic gear, falls into this latter category. All in all, a 6 percent rate of depreciation on the vessel and its total gear is probably too low. A 6 percent rate would result in depreciation changes of $72,360 on this amount of equipment. The total interest and depreciation charges would amount to $132,810, thus indicating a loss on investment in the industry assuming that the value, depreciation rate and the borrowing rate for investment funds are correct, and that the vessels engage only in salmon seining.

The above calculations have been based on the operations of seine vessels in salmon seine operations alone. It appears that some of these seine vessels are also engaged in other fisheries besides salmon at other times of the year. Operations in these other fisheries should also increase the return going to capital.

This chapter has reviewed the remuneration that fishermen receive for their efforts. The general conclusion is that they are below the alternatives available in other industries, and that the share system has had some effect as have government regulations and the common property feature.

Chapter IX

Summary and Conclusion

This thesis has been designed to examine the share system and to study its effects on innovation, income and employment in the British Columbia salmon fishing industry. The approach taken has been that of examining the theoretical basis of the share system and then noting how the system has worked in practice in British Columbia.

The share system has demonstrated some notable advantage over a wage system in attracting workers to a highly seasonal occupation, providing an incentive for hard work, and in the economizing of materials used. Against these advantages must be considered the assumption of risk which is shifted from the owners of capital to the fishermen and which results in instability in fishermen's incomes. Share fishermen are not assured that they will earn any income from a particular fishing trip and may, in fact, be forced to bear part of the losses of those ventures which fail.

This factor of risk shifting, however, has particular advantages to the capitalist in that it allows him to operate at a lower cost in bad times, at a sacrifice of earning less in good times. The sharing of possible losses increases the likelihood that a new technique or innovation will at least be attempted while the sharing of profits reduces the chances that any technique will actually be implemented on a permanent basis.

The effect of the share system on innovation is examined with the following results. The share system presents a fixed percentage cost to the entrepreneur and is a cost which varies directly with the welfare of the whole fishing enterprise. Labour costs under such circumstances become a rigid expense and every attempt will be made by the vessel owner to exploit his labour most efficiently. In fact, it would appear that the production function would be geared so as to utilize labour to a higher degree than it would be under a purely free enterprise competitive system. On a 4/11ths:7/11ths share, the yield on new capital innovations must be at least 2.75 times their costs before they can replace more labour intensive techniques under the operations of the British Columbia salmon seine share agreements. That innovation has taken place shows that these conditions must have been met at least by those boats that first utilized the innovations. Under the share system, it appears strange to have labour saving innovations unless they yield enough to at least pay the entrepreneur his costs. Those vessels which fail to adopt new techniques experience declining yields. In investment, bygones are bygones and it is the marginal return which determines the profitability of an innovation. As other vessels innovate, the yield of a given vessel declines, so that eventually it becomes profitable (or less costly) to either innovate or leave the fishery. The former is the most frequent as there are few alternative uses available for salmon seine vessels.

The employment of fishermen or individual salmon seine vessels has declined within the last ten years. This fact seems to contradict the expectations of the share system as being a strong force for retaining the status quo in labour utilization. The reasons for this decline have been noted above. The other outstanding feature of the seine fleet is the high rate of turnover among crewmen. These men obviously did not find the work sufficiently rewarding to entice them to remain. The share system may, in part, be responsible for this situation, since the possibility of the "big pay packet" which it presents may attract a surplus of labour, including many people who are later disillusioned by their actual returns.

The increased number of seine vessels has failed to keep pace with the expansion that the salmon fishery has experienced. There may be a number of reasons for this, with the share system being only one among many. The high capital cost involved in this type of vessel construction may be of particular significance. There is no organized and independent source from which a fisherman can easily and readily obtain the large amount of funds necessary for vessel construction. The increase in the number of combination vessels which fish in other fisheries besides salmon appears to indicate that the share system in these other fisheries is not a hindrance.

The actual rate of remuneration for those employed on seine vessels is difficult to gauge. It varies from year to year depending on the particular salmon runs which occur. Large

variability is also noted among individual vessels in the fleet. However, the role of the share system is to accentuate the gain of those who are on efficient vessels. The share system has the general effect of ensuring that a substantial part of any profits from innovation goes to the crew, while at the same time diminishing the chances that any specific innovations will take place.

The rate of return to capital does not appear to be high, especially considering the risks which are involved. To combat these risks many vessel owners have entered into charter arrangements with fish processing companies. These companies have the advantage of controlling and receiving the boat's share for a number of vessels, thus enabling them to average out their gains and losses. To the extent that such charters occur with great frequency, the significance of the role to be played by the vessel owner is diminished. The processing or fish packing companies, through their charter arrangements, determine to a significant degree the minimum equipment that the fishing fleet will possess. The charter rates vary depending upon the equipment on the vessel. Most companies, for example, pay an annual $400 bonus if a table seiner has a power block.

The share system has been examined in theory and in practice. Its merits can only be judged correctly in terms of the larger setting of the whole economy. In a progressive economy with many alternative opportunities for capital and

labour, the share system would be open to criticism as it leads to a misallocation of resources. If, on the other hand, the economy of the country is underdeveloped, then the share system may have a role to play in promoting the exploitation of a resource and the utilization of labour which would not have occurred otherwise. However, in general, the misallocation of resources which occurs due to the share system is relatively unimportant compared to that due to the common property feature. In offering fishermen and vessel owners the opportunity of receiving an economic rent from exploiting a "free" resource, it provides a special inducement for excessive amounts of labour and capital to enter the industry. This latter problem has only been mentioned and no solutions have been given as they lie outside of the share arrangements. The share system has many features similar to those found under any wage payment system and if there is complete flexibility in the share arrangements the two almost resemble each other. Thus the effects or consequences of the share system must be judged in relation to its setting in the whole economy.

Appendix 1

SUPPLEMENTARY AGREEMENT FOR SALMON SEINE VESSELS

SHARE BASIS AND FISHING CONDITIONS

This Agreement made and entered into this 26th day of June, 1961 between the Fishing Vessel Owners' Association of British Columbia, hereinafter referred to as the "ASSOCIATION" and the United Fishermen and Allied Workers' Union, hereinafter referred to as the "UNION".

ARTICLE I - DIVISION OF CATCH

From the gross value of the catch will be deducted the cost of fuel and lubricating oil. The resultant balance is to be divided on the basis of eleven (11) shares, four (4) shares to the boat and net, and seven (7) shares to the crew. From the seven (7) shares shall be deducted the cost of all provisions and the balance divided equally among the members of the crew.

ARTICLE II - CONDITION OF VESSELS

Section 1: It is agreed that at the start of the season all boats shall be inseaworthy condition in accordance with rules and regulations established by the Department of Transport.

Section 2: Proper fire fighting and life-saving equipment shall be provided on each vessel.

Section 3: Crew's quarters, galley and toil accommodation shall be in first class sanitary condition and the crew shall extend 100 percent cooperation in maintaining such cleanliness.

Section 4: In vessels where there is no toilet accommodation, same shall be installed if convenient and practicable before vessel leaves for the fishing grounds.

Section 5: The crew shall keep the fish hold and deck in a sanitary and neat condition throughout the season.

Section 6: It is agreed that at the beginning of each season

vessels shall be fully equipped with adequate crockery dishes and proper cooking utensils. At the end of each season the crew shall be responsible for the replacement of broken crockery and damaged utensils.

Section 7: A medicine chest shall be furnished to each vessel in accordance with requirements of the Workmen's Compensation Board. The Owners agree to maintain adequate replacement supplies aboard the vessels and the responsibility for the upkeep of a vessel's First Aid Chest shall be upon the Boat Delegate elected by the Crew.

ARTICLE III - BOAT DELEGATE

Section 1: A boat delegate, duly elected by the crew, shall be recognized by the Captain and the owner as the Union representative.

Section 2: The duties of the Boat Delegate shall be as follows:

(a) To ensure that correct tallies and records are kept;

(b) To ensure that settlements made with all or any members of the crew are fairly and correctly made. Each member of the crew shall receive a copy of the full settlement.

Section 3: The Boat Delegate duly elected by the crew, shall be cully recognized by the Owners as the representative of the crew and the Union on all matters connected with the weighing of fish. In order to facilitate the election of suitable representatives for this purpose the Owners shall, if requested by the Union, make available a list of crew members on their vessels.

ARTICLE IV - SETTLEMENTS

Section 1: When a crew member quits before the end of a season, he is entitled to his proportionate share of the catch.

Section 2: Settlements are to be made as quickly as possible at the conclusion of each season.

ARTICLE V - TRANSPORTATION

Should fishermen be discharged by any Owner or his agent at a port other than the port of hiring, the Owner agrees to furnish

steamer or scheduled airline transportation back to the port of hiring.

ARTICLE VI - CAPTAIN'S RIGHTS

Section 1: The Owners agree that seine boat captains shall have the right to hire and discharge their crew members.

Section 2: Should the Captain decide to discharge any of the crew members for cause during the fishing season, or should any of the crew members decide to quit during the fishing season, such notice of termination or discharge shall be given 48 hours in advance.

Section 3: In all matters pertaining to the operation of the boat, it is agreed and understood that the Captain's decision shall be final, subject only to instructions from the Owner or his representative.

ARTICLE VII - ILLEGAL FISHING

There shall be no illegal fishing and if any is done the Captain and the crew shall be jointly responsible for any fines or penalties imposed, except that the owner of the net or, where the skipper is responsible, the skipper shall be solely liable for any penalties imposed for over-length nets.

ARTICLE VIII - FUEL

Fuel tanks and lub-tanks will be filled by the Owner at start of each season and will be returned by the crew in a similar condition at close of each season.

ARTICLE IX - HOLE BILLS

Section 1: It is agreed and understood that hole bills shall not be collectable under the following circumstances:

(a) When men are discharged and it is definitely proven that such discharge was not due to any fault of their own;

(b) When the vessel goes into some other trade or other type of fishing;

(c) When crew members are discharged by the Captain for reasons other than the regular reasons;

(d) Where vessel is a total wreck;

(e) When an accident has occurred and the crew is not required

after repairs are completed.

Section 2: Definition: It is understood that hole bills as referred to in this Agreement shall denote a condition where the crew share of the landed catch at the time referred to in Section 1 (a), (b), (c), (d) or (e), is not sufficient to cover the cost of fuel, lubricating oil and provisions as set out in Article II of this Agreement.

ARTICLE X - LIMITING CATCH

The Owners agree that should it be necessary to place a limit on fish deliveries, such limit will be set on a per-man basis.

ARTICLE XI - CHARTER BOATS

It is agreed the terms and conditions of the Supplementary Agreement for Salmon Vessels - Share Basis and Fishing Conditions between the Fisheries Association of B.C. and the Union shall apply to all vessels chartered by the Operators during the 1961 season. All other vessels whose owners belong to the Fishing Vessel Owners Association of B.C. shall be bound by the terms of this Agreement.

ARTICLE XII - NET WORK

Section 1: The Union recognizes the responsibility of the seine crew to give proper care to the seine throughout and to the end of the fishing season, including necessary repairs, washing and bluestoning in accordance with management's instructions. It being understood that if it is not management's intention to strip the seine that it shall be returned in the same condition as received, reasonable wear excepted. Crews shall not be required to alter the dimensions of a seine or to effect major repairs when the vessel concered is terminating the season.

Section 2: Loading or unloading of seines shall not be considered net work and on arrival in port at the end of any season or for a layup, or to change over to another type of fishing, it shall be the crew's responsibility to bluestone, wash and unload the seine within a ten day period. In the event that the net is bluestoned on the day of arrival in port, the crew may be called out to wash and unload the seine on a day to be specified during the next ten days.

Any crew member who fails to appear on the day

specified unless his absence has been mutually agreed upon, shall be charged for eight hours' work at the regular netman's rate which sum shall be paid to the man taking his place. If there is no replacement, then the sum shall be equally divided amongst the seine crew members who perform the work.

Section 3: The Union recognizes the responsibility of the seine crew to deepen, shallow or shorten the seine during the fishing season in accordance with the captain's instructions. It shall also be the crew's responsibility to lengthen the seine provided that the extension which is to be added is made up beforehand. If the extension is not made up, and the crew is called upon to do this work, then they shall be paid in accordance with the terms of the current agreement on net work.

Section 4: Work done by members of the crew in preparing nets for each season and in stripping, washing stripped web, and storing nets at the end of each season shall be paid for by the owner of the net in accordance with the terms of the current Union Agreement on net work.

Section 5: The owners agree that should a seine, or seines, be put out which has not been relaced or rehung since the previous season and it becomes necessary for the crew to relace or rehang the seine within two weeks of the commencement of the net being fished, the members of the crew that worked on the seine shall be paid for such net work at rates set out in the Networker's agreement.

Section 6: The owner agrees that if, at the time of taking the seine, it is necessary for the crew to make up purse lines or brailers, payment shall be made for such work at the straight time rates set out in the Networker's Agreement. It is understood that putting such gear aboard is part of the regular operating and no extra payments be made.

Section 7: The Company shall provide seine crew members who are working on seines, including the loading, unloading, washing, bluestoning of same or working on brailers, purse lines or other fishing gear with Unemployment Insurance coverage for all such work for which payment is made by the company under the foregoing sections.

Section 8: In the performance of work and responsibility for work under the foregoing sections, the captain shall participate along with crew members.

ARTICLE XIII - CERTIFIED ENGINEERS BONUS

It is agreed that all certificated engineers engaged as engineers on salmon seine boats shall receive a bonus of $25.00 per month during the fishing season of 1961, said bonus to be paid by the Owners.

ARTICLE XIV - RADIO TELEPHONES

(a) Where radio telephones are installed on seine boats, it is agreed that the crew will not be required to pay for any installation or rental charge. Where crew members use the radio telephone for personal calls, excepting emergency calls, the Owners shall have the right to impose and collect a surcharge of 15 percent over and above the actual cost of such calls.

(b) It is further understood and agreed that the Owners shall have the right when settlements are being made to withhold the sum of $15.00 per man as a deposit, for a period not to exceed six weeks, to cover each crew member's personal calls.

ARTICLE XV - FAIR PRACTICES

During the term of this Agreement, no crew member shall be asked to make written or verbal agreements with the Owner covering rental of boat equipment or charges to gross stock unless such written or verbal agreement is approved by the General Executive Board of the Union.

ARTICLE XVI - GRIEVANCE PROCEDURE

All disputes that cannot be settled on board the vessel must be referred to the Owner or Owners concerned and the Union for adjustment.

ARTICLE XVII - TERMINATION

This Agreement shall be in full force and effect from the date of signature until June 15, 1962 and shall be continued thereafter unless notification in writing is given thirty (30) days prior to June 15, 1962 or of any year thereafter by either party desiring to change or modify any portion of this Agreement. Such notice, where the request is made for modification or change is desired and subsequent negotiations shall be confined exclusively to such requests. Negotiations shall commence as

quickly as possible following receipt of the thirty (30) days notice of modification of change.

Signed at Vancouver, B.C. this 26th day of June, 1961.

FISHING VESSEL OWNERS ASSN.
OF B.C.

George A. Brajcich, President

H. Christenson, Secretary

UNITED FISHERMEN & ALLIED
WORKERS UNION

Homer Stevens, Sec'y Treasurer

A. L. Gordon, Business Agent

Bibliography

I. Government Publications

Buchanan, D.R. and Campbell, B.A. The Incomes of Salmon Fishermen in British Columbia, 1953-1954. Ottawa, Department of Fisheries, 1957.

Canada, Dominion Bureau of Statistics. Annual Review of Employment and Payrolls, 1960. No. 72-201.

Canada, Dominion Bureau of Statistics. Fisheries Statistics, British Columbia, 1951-1961. Ottawa, Queen's Printer, 1962.

Canada, Dominion Bureau of Statistics. Monthly Review of Canadian Fisheries Statistics. Ottawa, Queen's Printer, 1951-1961.

Canada, Dominion Bureau of Statistics. Ninth Census of Canada, 1951, Fisheries, British Columbia. Ottawa, 1954.

Canada, Department of Fisheries. British Columbia Catch Statistics. Ottawa, Queen's Printer, 1951-1962.

Canada, Department of Fisheries. Campbell, B.A. A Review of the Fishing Earnings of Salmon and Halibut Fishermen in British Columbia, 1957 and 1958. Ottawa, Queen's Printer, 1960.

Canada, Department of Fisheries. The Commercial Fisheries of Canada. Ottawa, Queen's Printer, 1956. (Royal Commission on Canada's Economic Prospects, Vol. 12).

Canada, Department of Fisheries. Commercial Fishing Licenses, British Columbia - An Analysis of License Holders, Vancouver, 1957, 1959, 1960 and 1961.

Canada, Department of Fisheries. The Commercial Salmon Fisheries of British Columbia. Ottawa, Queen's Printer, 1956. (Statistical Basebook Series No. 3).

Canada, Department of Fisheries. Fisheries Statistics of British Columbia. Vancouver.. Mimeograph.

Canada, Department of Fisheries. Trade News. Vol. 3-4, 7-10, 1950-1952, 1954-1958. Ottawa.

Canada. Report of the Committee of Inquiry into the Unemployment Insurance Act. Ottawa, Queen's Printer, 1962.

Canada, Unemployment Insurance Commission. Survey of the Fishing Industry in Canada. Ottawa, 1951. Mimeograph.

Royal Commission Report Relating to the Use of (1) Trap-nets at Sooke Area and (2) Purse-seines in a Portion of the Gulf of Georgia (Area No. 17) in Salmon Fishing in British Columbia. Ottawa, H.M.P.O., 1940.

II. Periodicals and Newspapers

Crutchfield, J.A. "Collective Bargaining in the Pacific Coast Fisheries: The Economic Issues", Industrial and Labour Relations Review, VIII, July 1955, pp. 541-556.

Crutchfield, J.A. "Common Property Resources and Factor Allocation", Canadian Journal of Economics and Political Science, XXII (3), (August, 1956), pp. 292-300.

Gladstone, Percy. "Native Indians and the Fishing Industry of British Columbia." Canadian Journal of Economics and Political Science, XIX (1), (February, 1953), pp. 20-34.

Gordon, H. Scott. "An Economic Approach to the Optimum Utilization of Fishery Resources." Journal of the Fisheries Research Board of Canada, X (7), 1953, pp. 442-457.

Gordon, H. Scott. "The Economic Theory of a Common-Property Resources: The Fishery." Journal of Political Economy, LXII (2), (April, 1954), pp. 124-142.

Gordon, H. Scott. "Economic Factors in Catch Fluctuations." Journal of the Fisheries Research Board of Canada, XII, 1955, pp. 442-457.

Hacking, Norman. "Costly Strikes Have Often Paid Off." The Province, Vancouver. August 12, 1963, p. 21.

Jamieson, Stuart and Gladstone, Percy. "Union in the Fishing Industry of British Columbia." Canadian Journal of Economics and Political Science, XVI (1), (February, 1950), pp. 1-11, and XVI (2), (May 1950), pp. 146-171.

Johnson, D. Gale. "Resource Allocation Under Share Contracts." Journal of Political Economy, LVIII (2), (April, 1950), pp. 111-123.

"Pacific Coast Purse Seine Operations." Western Fisherman, XLIV, (May,1952), pp. 82, 84; XLV, (October, 1952), pp. 14, 48.

The Pacific Fisherman Yearbook. Miller-Freeman Publications, Seattle, Washington, 1951-1961.

"Purse Seine Construction." Western Fisherman, XLIV, (May, 1952), pp. 86, 88, 92, 94, 96. Also,(September, 1952),pp. 15-16, 46.

"Report of the Standing Committee on Commercial Fisheries." Transactions of the American Fisheries Society. Ann Arbor, Michigan, 1953-1956.

Scott, Anthony. "The Fishery: The Objectives of Sole Ownership." Journal of Political Economy, LXIII (2), (April, 1955), pp. 116-124.

"Trends in the Usage of Nylon Twine and Web." Western Fisheries. March, 1952, pp. 18-19.

Vermeulen, A. "Collective Profit-Sharing." International Labour Review, LXVII, (June, 1953), pp. 495-519.

Young, S.L. "Nylon Nets Tested on the West Coast." Trade News. February 1952, pp. 14, 16.

III. General Works

Carrothers, W.A. The British Columbia Fisheries. Toronto, Toronto University Press, 1941. (Political Economy Series, No. 10).

Conditions of Work in the Fishing Industry, Vol. 30. Geneva, International Labour Office, 1952. (Studies and Reports New Series, No. 30.)

Crutchfield, J.A., ed. Biological and Economic Aspects of Fisheries Management. Seattle, University of Washington, 1959.

De Loach, Daniel B. The Salmon Canning Industry. Corvallis, Oregon, Oregon State College, 1939. (Economic Studies, No. 1).

Fisheries Policies of Western Europe and North America. Organization for European Economic Co-Operation, 1960.

Gregory, Homer E. and Barnes, Kathleen. North Pacific Fisheries with Specific Reference to Alaska Salmon. New York, American Council Institute of Pacific Relations, 1939. (Studies on the Pacific, No. 3).

Innis, Harold. The Cod Fisheries, 2nd ed. Toronto, Toronto University Press, 1954.

Sinclair, Sol. License Limitation - British Columbia, a Method of Economic Fisheries Management. Ottawa, Department of Fisheries, 1960.

Taylor, R.A. The Economics of White Fish Distribution in Great Britain. London, Duckworth, 1960.

White, Donald J. The New England Fishing Industry. Cambridge, Harvard University Press, 1954.

IV. Special Works

Carrothers, J.G. "The Physical Properties of Netting and Twines Suitable for Use in Commercial Fishing." Modern Fishing Gear of the World, ed. Hilmar Kristjonsson. London, Fishing News, (Food and Agriculture Organization of the United Nations), 1959, pp. 69-74.

Cobb, John. Pacific Salmon Fisheries, 3rd ed. (Document No. 902), May, 1921. Report of the Commissioner of Fisheries, Washington, D.C., U.S. Government Printing, 1922.

Economic Effects of Fisheries Regulation. ed. R. Hamlisch. Rome, Food and Agriculture Organization of the United Nations, 1962. (Report of an F.A.O. expert meeting at Ottawa, June 12-17, 1961.)

Francois Quesnay et la Physiocratie, 2 vols. Paris, Institut National d'Etudes Demographiques, 1958.

Hicks, J.R. Theory of Wages. London, Macmillan, 1933.

Jones, Richard. An Essay on the Distribution of Wealth, [1831] New York, Kelley and Millman, 1956. (Reprints of Economics Classics).

Kirby, E.S. and Szczepanik, E.F. "Special Problems of Fisheries in Poor Countries." The Economics of Fisheries, ed. Ralph Turvey and Jack Wiseman. Rome, Food and Agriculture Organization of the United Nations, 1957, pp. 83-119.

McCulloch, J.R. Treatises and Essays, 2nd rev. ed. Edinburgh, Adam and Charles Black, 1859.

Malthus, T.R. Principles of Political Economy, 2nd ed. London, William Pickering, 1836.

Marshall, Alfred. Economics of Industry, 3rd ed. London, Macmillan, 1899. (Elements of Economics, Vol. 1)

Marshall, Alfred. Principles of Economics, 8th ed. London, Macmillan, 1920.

Mill, John Stuart. Principles of Political Economy, New ed. ed. Sir W.J. Ashley. London, Longmans Gree, 1909.

Parsons, Kenneth, H. et al. eds. Land Tenure. Madison, Wis., University of Wisconsin Press, 1956. (Proceedings of the International Conference on Land Tenure and Related Problems in World Agriculture Held at Madison, Wisconsin, 1951).

Rounsefell, George A. and Kelez, George B. "The Salmon and Salmon Fisheries of Swiftshore Bank, Puget Sound and the Fraser River." (Bulletin No. 27, October 17, 1938). Bulletin of the U.S. Department of Fisheries, XLVIII, Washington, D.C., U.S. Government Printing, 1940, pp. 693-832.

Russell, E.S. The Overfishing Problem. Cambridge University Press, 1942.

Salter, Leonard A. Jr. A Critical Review of Research in Land Economics. Minneapolis, University of Minnesota Press, 1948.

Say, Jean Baptiste. A Treatise on Political Economy, 4th ed. Trans. C.R. Prinsep. New American Edition, Philadelphia, Lippincott, 1857.

Schmidt, Peter J. Jr. "The Puretic Power Block and its Effects on Modern Purse Seining." Modern Fishing Gear of the World, ed. Hilmar Kristjonsson. London, Fishing News, (Food and Agriculture Organization of the United Nations), 1959, pp. 400-413.

Shackle, G.L.S. "The Nature of the Bargaining Process." The Theory of Wage Determination. ed. J. Dunlop. London,

Simonde de Sismondi, J.C.L. Etudes sur l'Economie Politique, Vol. 1. Paris, Treuttel et Würtz, 1837. (Erudes sur les Sciences Sociales, Vol. 2).

Sismonde, M. de. Political Economy and the Philosophy of Government. Trans. M. Mignet. London, John Chapman, 1847.

Smith, Adam. The Wealth of Nations, [1776]. ed. Edwin Cannan, New York, The Modern Library, 1937.

Young, Arthur. Travels in France. ed. M. Bentham-Edwards, 2nd ed. London, George Bell, 1889.

Young, Arthur. Travels in France during the Years 1787, 1788 and 1789. ed. Constantia Maxwell. Cambridge University Press, 1929.

Young, Arthur. A Tour in Ireland. ed. Constantia Maxwell. Cambridge University Press, 1925.

Zoeteweij, H. "Fisherman's Remuneration." The Economics of Fisheries, ed. Ralph Turvey and Jack Wiseman. Rome, Food and Agriculture Organization of the United Nations, 1957, pp. 18-41.

V. Unpublished Material

Gladstone, Percy H. Industrial Disputes in the Commercial Fisheries of British Columbia. Vancouver, University of British Columbia, 1959.

Report on Nylon Nets. Canada, Department of Fisheries, 1952.

Rigby, William. Memorandum on the Limitation of Licenses in British Columbia Salmon Fishery and Related Matters. Vancouver, 1958.

Rigby, William. Statement to Conciliation Board on Drum-Seine Share Dispute. United Fishermen and Allied Workers Union, 1954.

Submission to the Committee of Inquiry into the Unemployment Insurance Act, United Fishermen and Allied Workers Union, Vancouver, 1961.

Submission to the Honourable Ernest Bertrand by the Fishermen, the Companies and Others; The Salmon Industry of British Columbia, Vancouver, 1945.

Supplementary Agreement for Salmon Seine Vessels Share Basis and Fishing Conditions Between Fishing Vessel Owners Association and the United Fishermen and Allied Workers' Union, June 26, 1961.