BIOLOGICAL AND ECONOMIC ASPECTS OF THE NEWFOUNDLAND COD FISHERIES

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by

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Abstract

This study examines economic and biological aspects of the Newfoundland cod fisheries in an attempt to explain why this industry, particularly the inshore sector, is continually in economic straits.

The study can be divided into two segments, the first setting the groundwork for the analysis contained in the second part. To provide a groundwork, the first segment deals with the biological aspects of the cod stocks, the economic theory of a sea fishery, and the record of government attention to the Newfoundland cod fisheries.

Several distinct stocks of cod are found to exist around the Newfoundland coast, however, all of these do not approach close enough to shore to be available to the inshore cod fishermen. Even more significant is the fact that the stocks which do migrate within range of inshore gears are also fished on the offshore grounds before and after their inshore movement. This multiple fishing of these stocks is deemed to create an externality for the inshore cod fishery. Certain other behaviourial characteristics of the cod have been said to have special implications for the inshore fishery. These include the tendency for cod to remain in cold water, avoid excessive light, and become sluggish if well fed.

The economic theory of a sea fishery, as developed by several authors, is reviewed to provide guidelines for later analysis. The significant point of this theory is that sea

fisheries tend to become overexploited because no one operator can appropriate the rent from the resource. Consequently, fishing effort is pushed beyond the economic optimum point and returns to factors engaged are depressed. This course of action may push the fishery even beyond the point of the biological optimum which has been the usual goal of fishery administrators in the past. This tendency will be the focal point of the inshore fishery analysis.

The review of government attention to the fishery centres on two aspects: regulation and assistance. Most of the regulations are found to affect the inshore cod trap fishery. However, in toto, these rules are directed mainly to achieving orderly fishing or protecting operators of a certain type of gear rather than economic fishing levels. The record of government assistance has had two phases: pre-Confederation and post-Confederation. In the first the objective of the programmes was to achieve orderly and efficient marketing with little attention given to improving productivity at the primary level. The second phase was characterized by attempts to improve the capital base of the fishery through subsidization of vessels, fishing gear and materials.

The analytical section begins with an examination of the inshore cod fishery in the period since 1937. Several trends are found to exist over this period. Landed volume has steadily declined while value of catch has risen. The number of men

employed fell rapidly in the early fifties and showed some upward movement thereafter but never reattained former levels. There is no legal restriction on entry to this fishery but exit is hindered by several factors: lack of education, isolation and general psychology. Technology has not yet changed significantly and catching apparatus lack the element of pursuit characteristic of more mobile fishing fleets. The major problem is found to be one of too many men chasing fewer and fewer fish but incurring higher costs as time goes on. Government policy has had the unfortunate result of encouraging both improvements in technology and maintaining high numbers of fishermen. All these ills are concurrent with uneconomic offshore fishing effort reducing the stocks exploitable inshore.

The offshore codfishery is very different from the inshore. A highly mobile fleet consisting mainly of otter trawlers, fish cod only a small percentage of the time. The otter trawler fleet is company-owned and thus tends to fish species that are not available in sufficient quantities inshore. But this fleet must overcome certain inefficiencies if future cod landings are to be economically maintained at present levels. These problems are found to centre around low catches, high average costs, low average revenue and poor operating times.

It is finally decided that manpower in the inshore cod fishery must be reduced if that fishery is to be more economic or less uneconomic. The offshore cod fishery will have to supply

more landings in the future if demand continues at present levels. If this is to be done economically, improvements in the operating efficiency of the offshore fleet must be made. Recommendations for achieving these ends are offered. They centre mainly on restricting entry to the inshore fishery and achieving fuller utilization of the existing offshore fleet before expanding it.

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Eric B. Dunne

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St. John's, Newfoundland.

1. INTRODUCTION

Throughout its existence the Newfoundland cod fishery has not lacked government attention and assistance. Various plans have existed at one time or another to assist or develop the fishery. However, the continual plight of the industry is ample proof these schemes have not eliminated all the causes of its problems. Some change in the methods used to assist or develop the fishery is obviously overdue. This study will attempt to explain some of the factors that must be considered if future policies are to be more successful than those of the past. While the discussion will be confined to the Newfoundland inshore and offshore cod fisheries, the conclusions and recommendations are typical of the problems of most marine fisheries.

The inshore cod fishery is defined by the Department of Fisheries of Canada as including the operations of all fishing vessels under 25 gross tons and all Labrador floater vessels. In effect, this means the inshore fishery consists of operations usually carried on within sight of land. The movements and divisions of the cod stocks exploited by this fishery are fairly well defined. We shall, therefore, treat the inshore cod fishery as a separate fishery in much the same manner as the models derived by economists such as Gordon and Scott.

While the offshore fishery is officially defined as including all fishing vessels over 25 gross tons, the smaller offshore craft, longliners and draggers, mostly fish on the same grounds as the inshore boats. In our discussion of the offshore cod fishery we shall

concentrate mainly on the larger offshore craft, the otter trawlers. The problems of smaller offshore vessels are not essentially different from those of the regular inshore craft. Even though the offshore statistics include the smaller draggers and longliners, we shall not normally include their operations in our analysis of the offshore fishery.

Because of its importance in terms of total landings, landed value and men engaged, our attention will be centred mainly on the inshore cod fishery. The men, boats and equipment employed in this fishery are used but little in other fishing activities. Cod fishing, on the other hand, is only a minor part of the activities of the offshore fleet. However, this will become more important in the future, and so the offshore cod fishery deserves some consideration also.

Before explaining the order of our analysis a few words on the statistics used will be in order. In most cases the post-1950 data on the inshore and offshore cod fisheries are taken as tabulated by the Economics Branch of the Department of Fisheries of Canada, St. John's, Newfoundland. Other sources such as the Dominion Bureau of Statistics or the International Commission for the Northwest Atlantic Fisheries were used as indicated in the various source references. Data on the catch and value, men and vessels for the years before 1950 were obtained from the Annual Reports of the Newfoundland Fisheries Board or the Census Reports for 1935 and 1945.

The amount of landings for the years 1937 to 1949 was estimated from the salted cod production and fresh and frozen cod exports data contained in the Reports of Newfoundland Fisheries Board. The landed values for these years were calculated using rough averages of prices paid for salted cod and amounts paid to fishermen by freezing plants for fresh cod. This was done separately for the inshore and offshore cod fishery as landings data were available for deep sea vessels by tonnage classes. Vessels under 25 gross tons which were reported as part of the deep-sea fleet were re-tabulated with the inshore fleet. For the years 1945 to 1952 estimated cod catches by otter trawlers and draggers were added to the offshore landings. This procedure is considered satisfactory because we are more concerned with trends than absolute levels of catch and landed value.

The statistics on boats and fishing gears employed in the inshore cod fishery are available in detail only from 1954. While the types and numbers of gears used to catch cod are easily definable, this is not true of the inshore cod fishing fleet. We, therefore, simply assumed that all inshore boats as reported by the Canada Department of Fisheries fish for cod for some part of the year.

The limitations of the data are not serious because our main purpose is to present broad descriptions of the problems inherent in the structure of the inshore cod fishery. The offshore cod fishery is not as homogenous as the inshore sector and so our analysis of it will be slightly different.

The inshore cod fishery will be examined in the light of the biological and economic theory of fishery exploitation. However, we shall dismiss the rent maximization postulate because of the immense problems of achieving such an optimum. We shall concentrate instead on the effects of open resources on entry of men and capital. Even this limited application will amply show the mistakes of past policies.

Our study will, therefore, proceed in the following order:

To set the stage for our discussion of the inshore cod fishery we shall first dwell on the biological nature of the Newfoundland cod stocks, the economic theory of fishery exploitation, and government assistance and fishery regulations. These subjects will be covered in Chapters 2, 3 and 4 respectively.

The inshore fishery will be the subject of Chapter 5. The historical trends will be discussed as well as problems of entry, fishery regulations, and government assistance policy. The influence of the cod resource will be explained and the effectiveness of catching methods analysed. When these matters have been covered, the problem of the inshore cod fishery will be restated in general terms of the economic models.

The offshore cod fishery will be analysed in Chapter 6. The main items covered will be past performance, the durrent problems of the otter trawler fleet and the effects of the offshore competition for the cod stocks.

The two fisheries will be compared in Chapter 7 which also contains an outlook for the future.

The discussion is summarized in Chapter 8, which contains conclusions and a plan of development and management.

11. The Available Cod Resources

(i) Meaning and Importance of Fish Stocks

The Newfoundland cod fishery provides employment and income to a significant number of the province's labour force and a long standing supply of good protein food to consumers in many countries. The cod stocks in the waters around Newfoundland also provide employment and income to fishermen of many other countries. As will be seen later, this is one of the major difficulties in developing and managing this fishery.

It has been recognized in recent years that fishery population dynamics have important implications for economic development or management of a fishery. Not only do biological factors affect the methods which must be employed in such programmes, but they are also a determinant of the existing structure or method of exploitation. This point will be examined more closely after the existing cod stocks have been discussed. (See Chapter V).

Before proceeding, the words "population" and "stock" should be defined. The former is used to refer to a species occupying any defined area at some particular time. "The word "stock" is used to denote more unity in the group with respect to its greater degree of inter-mingling within itself and considerably less mixing with other groups, or a withdrawal to its own territory during some part of the year, whether for spawning or feeding, etc. A stock is a recognizable unit in which most of the fish have a similiar area-occupying and migratory pattern." (1)

There are also often physical differences such as growth rates, vertebral numbers, etc. among different stocks.

(ii) Cod Stocks

Cod (gadus morhua) is by far the most important species in the fisheries of Newfoundland. Since 1953 landings of cod have averaged 65.3 per cent of landed weight and 61.7 per cent of landed value annually. This predominance is even more marked in the inshore fishery where over the same period, this species has averaged 78.1 per cent of volume and 72.5 per cent of value.

Several stocks of cod are known to exist in the waters around Newfoundland (2). Some of these are available to both the inshore and offshore fisheries; others are exploitable only by offshore vessels because of their distance from coast at all times of the year.

One large stock of cod is found along the east coast of Newfoundland and Labrador extending roughly from the northern part of the Grand Bank to the northern tip of Labrador. In this stock there is a general movement onshore in summer and offshore in winter, the onshore summer movement providing the supply for the inshore fishery along this whole section of coast. This onshore movement, a feeding migration, is earlier in the south than in the north. It thus provides the inshore fishery in the latter half of June in the southern part of the east coast of Newfoundland, the first week of July in southern Labrador, and the first week of August farther north.

The stocks of cod along the south coast of Newfoundland are smaller and considerable intermixing occurs. Three different stocks can be identified in this area: (1) The Avalon-Burin stock, (2) the Burgeo Bank stock, and (3) the St. Pierre Bank stock.

The Avalon-Burin stock in the east, extends roughly from St. John's to Fortune Bay. This stock overlaps with the Burgeo Bank stock. During the winter it mixes to a limited extent, with the West Newfoundland stock, the St. Pierre Bank stock at its northern fringes, and the western Grand Bank stocks. The Avalon-Burin stock is an inshore one providing the inshore fishery in the Southern Avalon to Fortune Bay area during its onshore movement in summer.

The Burgeo-Bank stock occupies the Burgeo Bank during winter and early spring, moving inshore during the summer along the western half of the South Coast of Newfoundland. During this time there is some slight intermingling with the cod of the West Newfoundland and Avalon-Burin stocks.

The St. Pierre Bank stock concentrates on the western and southern slopes of the Bank in the winter and early spring. Feeding concentrations occur on the shallower parts of the Bank during late spring, summer and autumn. Many of these cod migrate to the inshore waters of the South Coast in late spring and early summer, thereby producing the summer fishery of this region.

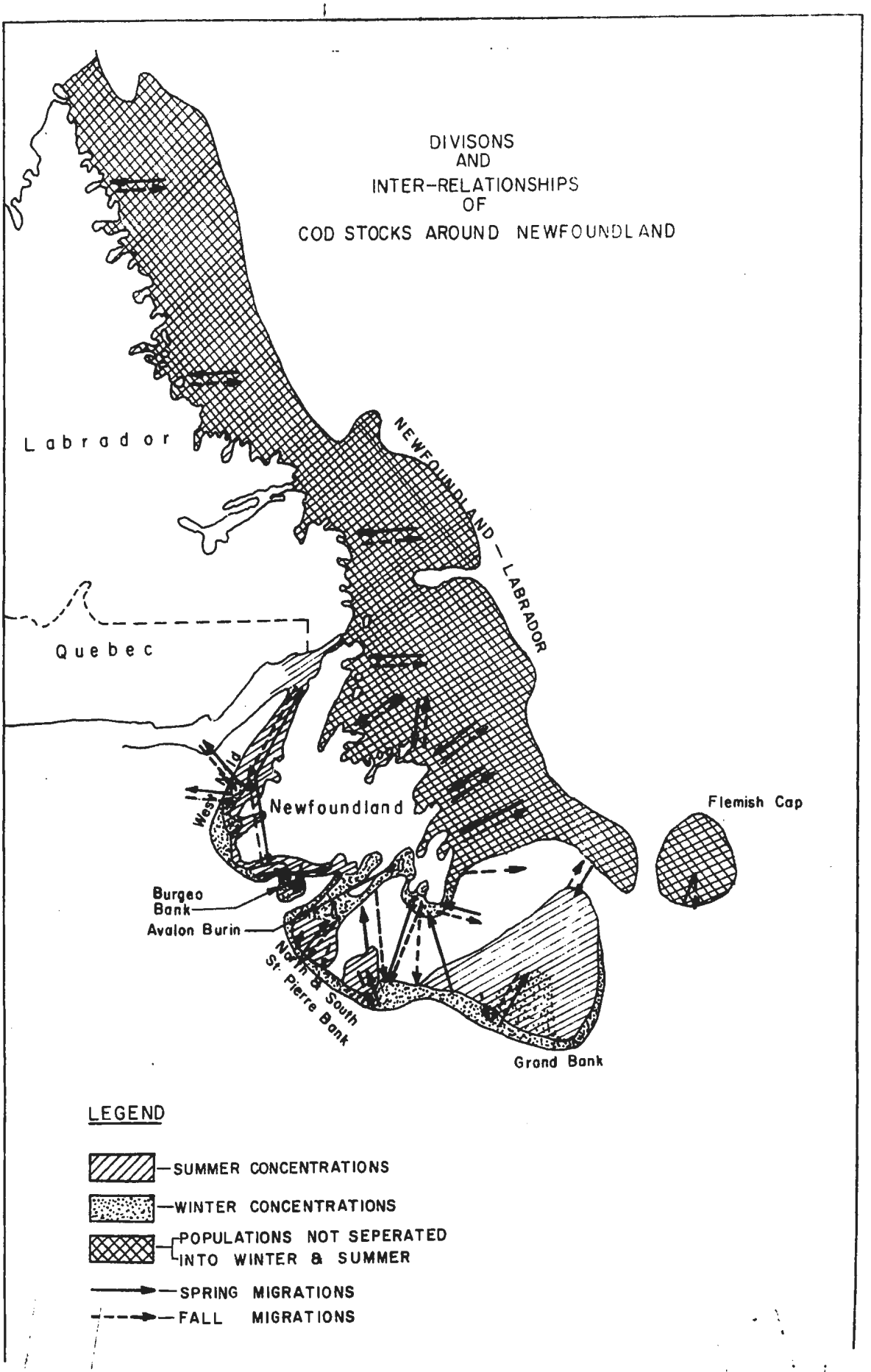
On the west coast, the west Newfoundland stock extends northward to the vicinity of the Strait of Belle Isle. At its northern

fringe it tends to mix with cod of the Labrador-East Newfoundland stock, at least as far as older fish are concerned. There is also some occasional intermingling off the South Coast during winter and spring with the Burgeo Bank and St. Pierre Bank stocks. This stock produces the winter fishery in the Southwest Newfoundland Coast area and the inshore cod fishery along the West Coast during migrations northward and southward in the Gulf of St. Lawrence. It is also heavily exploited in late winter to early spring by otter trawlers of several countries operating in the south-eastern Gulf of St. Lawrence.

These are the only cod stocks available to both the inshore and offshore fisheries of the Island. There are other cod stocks in the North West Atlantic available to offshore vessels only from Newfoundland ports (3).

The most widely known offshore cod stocks are those found in the Grand Bank area to the southeast of Newfoundland. Two separate stocks of cod can be distinguished in this area; The Flemish Cap stock and the Grand Bank stock. Not much is known about the westward movement of the Flemish Cap stock. But the southerly movement to the south of the Cap for spawning, and the intervening Flemish Channel to the westward (600 fathoms or more in depth), indicate most of this stock remains there throughout the year.

The Grand Bank stock may be made up of two separate groups with different vertebral averages. It could be that one group spends the winter and spawns to the southward and the other spends the winter


DIVISONS
AND
INTER-RELATIONSHIPS
OF
COD STOCKS AROUND NEWFOUNDLAND
Labrador
NEWFOUNDLAND — LABRADOR
Quebec
West Nfld
Newfoundland
Flemish Cap
Burgeo Bank
Avalon Burin
North & South St. Pierre Bank
Grand Bank
LEGEND
SUMMER CONCENTRATIONS
WINTER CONCENTRATIONS
POPULATIONS NOT SEPERATED INTO WINTER & SUMMER
SPRING MIGRATIONS
FALL MIGRATIONS

and spawns northward, intermingling taking place as part of each group passes over the surface of the Bank in summer.

Whatever is the composition of this stock there appears to be no large scale onshore migration and consequent mixing with the coastal Avalon-Burin stock. However, there may be some intermingling by the cod of the Grand Bank stock closest to the Coast with the coastal stock while those farther away on the southern part of the Bank will have no such intermingling. The Flemish Cap stock and most of the Grand Bank stock are exploitable only by deep-sea vessels.

Several more stocks of cod are present in the waters of western part of the Gulf of St. Lawrence in summer but migrating to the Nova Scotian Shelf in autumn and winter. At that time there is some intermingling with the West Newfoundland stock. Other stocks are quite separate from the coastal Newfoundland stocks at all times of the year. While Newfoundland trawlers fish these stocks, mainly in the Gulf, they can be considered as marginal cod stocks for the Newfoundland fishery.

The divisions and inter-relationships of the cod stocks described above are shown in Figure 1.

(iii) Some Special Implications for the Inshore Fishery.

Obviously the movements of a stock of fish has little significant effect on the productivity of a mobile sea-going trawler fleet. However, the land-bound, immobile inshore fleet is almost completely dependent on the shore-ward movement of the stock. In the entire history of the

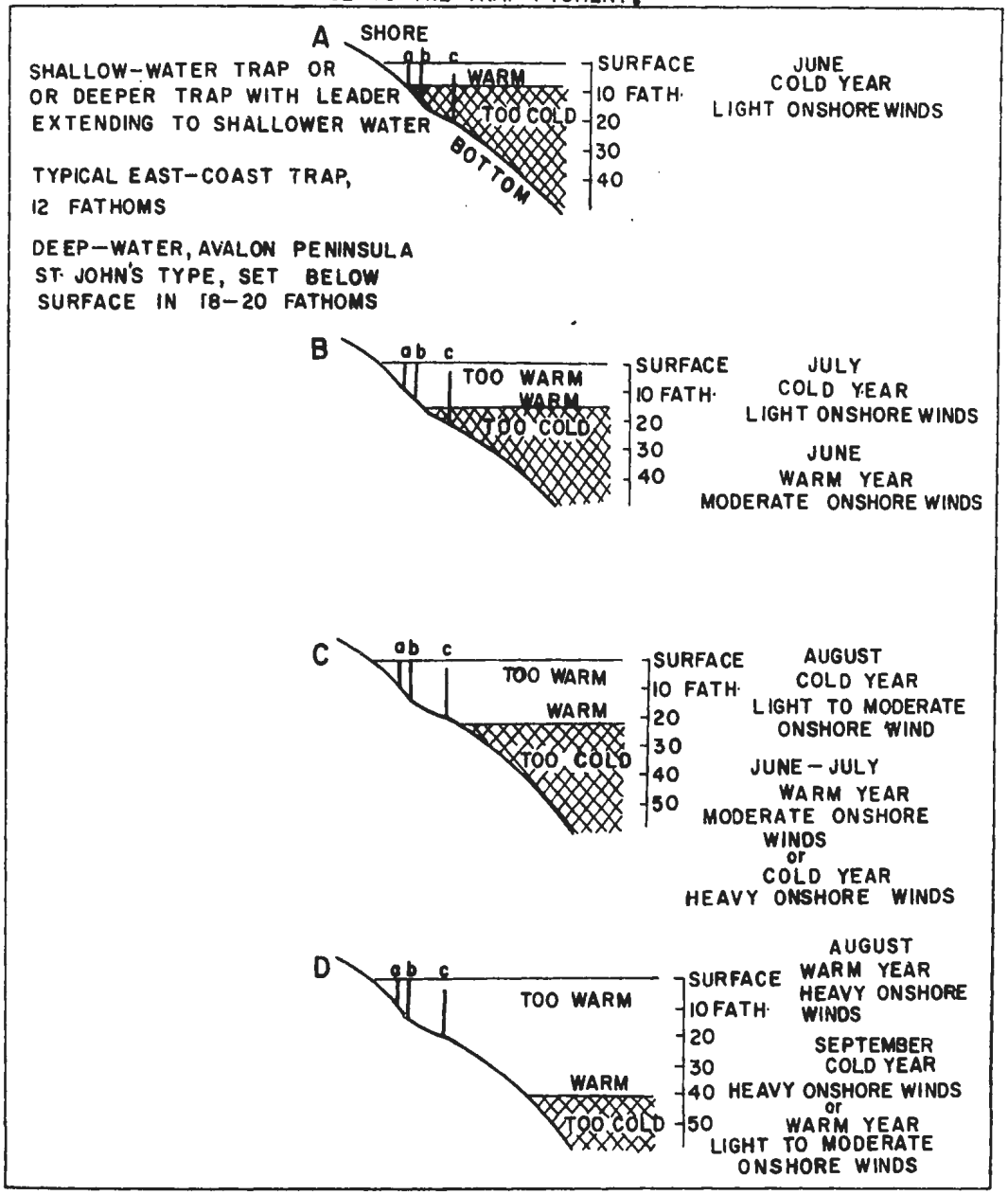
inshore cod fishery if the cod came to shore, catches were high, if not, landings were low.

Templeman (4) has pointed out some interesting and crucial facts on determinants of cod movements which go far in explaining the annual success or failure of the inshore fishery. The first of these, hydrographic conditions, also determine the areas of relative abundance in coastal waters. Cod prefer cold water. With prevailing west and southwest winds during summer, the warm surface water is blown offshore from the east coast, including the eastern sides of the large peninsulas. Therefore, landings come in relative abundance from the east coast and in particular from the eastern sides of the peninsulas. On the east coast also the Labrador Current has an onshore tendency and helps keep the water cold. Beyond the Burin Peninsula its onshore effect is not great in most years.

The south coast west of Fortune Bay, and the west coast are little affected by the Labrador current. There the prevailing west and southwest winds force the warmer water onshore and the cod is usually too far offshore in summer to be taken by the inshore traps and handlines. The period December to April is the time of winter fishing in the Port aux Basques-Rose Blanche area when the inshore waters are colder. Unlike the east coast, this whole section is not suitable to cod-trap fishing because of these conditions.

FIGURE 2

VARIATIONS IN TEMPERATURE CONDITIONS IN VARIOUS MONTHS ON THE EAST COAST OF NEWFOUNDLAND, AND THEIR EFFECTS ON WATER LAYERS AND ON AVAILABILITY OF COD DUE TO THE TRAP FISHERY.



Source: Templeman, W. Marine Resources of Newfoundland, Fisheries Research Board of Canada, Ottawa, 1966, p.48.

Apart from determining the local occurences of cod, the water temperatures play a major role in the year-to-year success of the inshore trap and handline fishery, especially on the east coast.

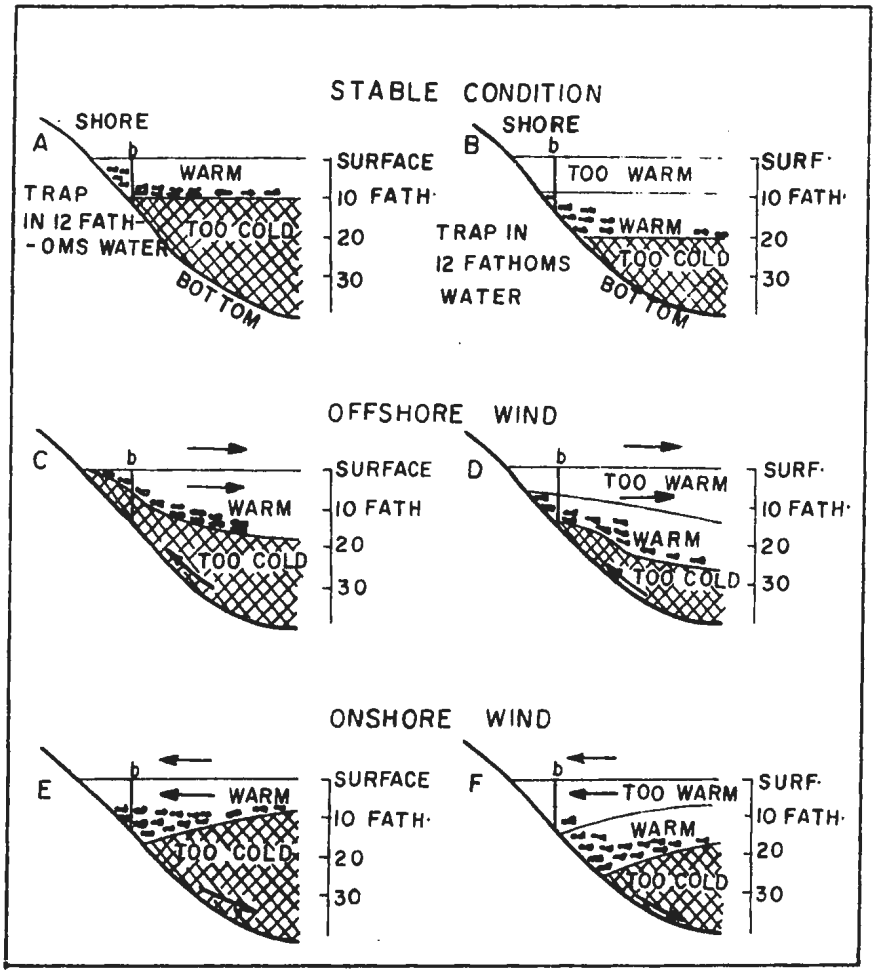
When the cod migrate inshore, they move in an intermediate layer of water between the too warm upper layer and the too cold bottom layer. The depth of this intermediate layer determines how close cod will come to the shoreline and be available to the inshore gears: cod traps, handlines and trawls (See Figure 2).

In some years there may be little onshore winds as the surface water warms in May and June. There are then no large waves to mix the warmer surface water with the cold layer underneath. The warm layer (and the intermediate layer) remain shallow. This leaves a small bottom area with suitable water temperatures for cod. When the fish follow the caplin to shore, they come very close because of this restricted area. If these conditions continue into July, the cod may stay in shallow water close to shore throughout July, early August, and even later in certain areas. The same situation would be created by a cold winter with considerable ice and a late spring. In such a year traps and handline fishing begin late but usually last longer than in a warm year when the shallow surface water warms more quickly.

In years of onshore winds in June or early July the opposite conditions will prevail. The warm surface layer will be mixed with the cold layer below, thus creating temperatures suitable for cod at a deeper

FIGURE 3

EFFECTS OF OFFSHORE AND ONSHORE WINDS ON WATER LAYERS AND WATER TEMPERATURES ON THE EAST COAST OF NEWFOUNDLAND, AND ON AVAILABILITY OF COD TO THE TRAP FISHERY.



Source: Templeman, W. Marine Resources of Newfoundland, Fisheries Research Board of Canada, Ottawa, 1966, p. 50.

depth. The bottom area cod can occupy will now be greater and they will not approach as close to shore and be available to traps and handlines. The same conditions would be caused by a warm winter and early spring. In such a year a relatively thick surface layer of warm water may develop by the latter part of June (the intermediate layer will then be deeper and farther from the shore).

The inshore conditions in individual localities could give rise to more complex situations. The movements of inshore cod are then not as simple as described above. The differing conditions can especially affect the cod trap fishery (See Figure 3).

If a strong offshore wind occurs at the beginning of the trap season, it would be unfavourable because it would force the warm surface layers (and the intermediate layer) farther offshore. Most of the cod may then move out of the range of cod-traps. Such a wind may be favourable late in July or August when the warm surface layer extends so deep that cod have moved out of the range of traps. Then as the warm layer moving offshore is reached at a depth by water suitable for cod they may move shoreward with it. These conditions could change several times in the course of a trap fishing season. As well the effects would be different in bays where an offshore wind on one side may be an inshore wind on the other.

Onshore winds would have opposite effects. They would bring the cod onshore when the warm layer is originally very thin and not too warm and driving them away from shore when the warm surface layer is made too deep.

Light can also have an important effect on the inshore cod fishery. Light penetration is determined by the amount of sunlight and of fog, as well as the transparency of the sea water. Compared with large cod, small cod can endure greater extremes of temperatures and brighter light. In a year when conditions are favourable to the penetration of light commercial-sized cod may not be taken by inshore traps and handlines except for periods at night.

Cold water on the cod wintering grounds may delay spawning. God feed much more heavily after than before spawning. If cod spawn late, they may not make contact with the shoreward-moving school of caplin. When this happens, smaller quantities of cod than usual will concentrate into the small inshore area where they may be fished by inshore gears.

As the cod stocks continue to be reduced a higher percentage of the reduced stock will possibly find enough food in the deep water after their April-June spawning, which may be 100 miles or more offshore. Thus they may not need to move inshore for feeding. If caplin becomes more relatively plentiful, the cod, while inshore, will become glutted more quickly and remain so for a longer period. They then will not take bait until late July or early August when the caplin move offshore. Moreover, if the cod become glutted quickly enough, they may remain close to or on the ocean floor; they may not move enough to be caught readily by either traps or gill-nets.

It should now be obvious that the inshore cod fishery is greatly influenced by the biological behaviour of the cod. As will be shown in more detail later, the types of gear used in the inshore fishery compound rather than eliminate the problems caused by this biological behaviour. Although not hampered to the same extent by population dynamics, the offshore fishery nevertheless has yielded a rather small percentage of total cod landings. This point will be developed more fully in Chapter V.

A demersal fishery, such as the cod fishery, is characterized by certain biological-economic factors which have important implications for economic exploitation and management. These will be dealt with in the following chapter.

Notes to Chapter 11

(1) Templeman, W. "Division of Cod Stocks in the Northwest Atlantic", ICNAF Redbook 1962 Part 111, International Commission for the Northwest Atlantic Fisheries", Dartmouth, N.S., 1962, p.81.

(2) Ibid., pp. 105-112

(3) Ibid., pp. 108-110

(4) Templeman, W., Marine Resources of Newfoundland, Fisheries Research Board of Canada, Ottawa, 1966, pp. 37-51.

III. Biological and Economic Optima of a Fishery

The economics of exploitation in a given fishery as developed by Gordon (1) and later expanded by Scott (2) and Crutchfield (3) are based on biological interrationships among fish populations, fishing effort and landings. Prior to and since their writings, most conservation programmes, national or international, have attempted to achieve the biological optimum of maximum sustained physical yield rather than the economic optimum of maximum net revenue. In various fishery development schemes in Newfoundland no attention has been paid to either. We shall now examine the relationship of biological and economic factors that operate in a fishery. Hopefully, we will obtain some deeper insight into the problems that have plagued the cod fishery of this province and some new guidelines for future development.

(1) Biological Equilibrium and Optimum of a Fishery

First, we shall examine how a fishery achieves biological equilibrium and what the optimum biological position means for a demersal sea fishery.

The cod, and most other demersal sea fishes, are of a natural resource for which the annual rate of natural reproduction is a function both of the physical environment, which is assumed constant over time, and of the size of the existing population which is diminished by the rate of harvesting. Such resources tend to remain in dynamic balance over some sufficiently long period of time; losses will be balanced by accessions or recruitment to the population or stock. If the rate of loss is increased, for whatever reason, the rate of renewal must increase so that balance is again achieved.

Fishing by man is simply another source of loss to the population or stock. This will be met by a compensatory increase in natural reproduction until the population again comes into balance at some lower level where increased recruitment equals natural mortality plus landings (4). There is then a circular relationship among landings, population size, rate of population growth, and fishing effort. The natural rate of increase is a function of population size; landings a function of population and fishing effort; while the population size is itself related to fishing effort. The equilibrium catch can be defined as that level of catch which is exactly equal to the rate of natural increase. Under these conditions population size will be stable.

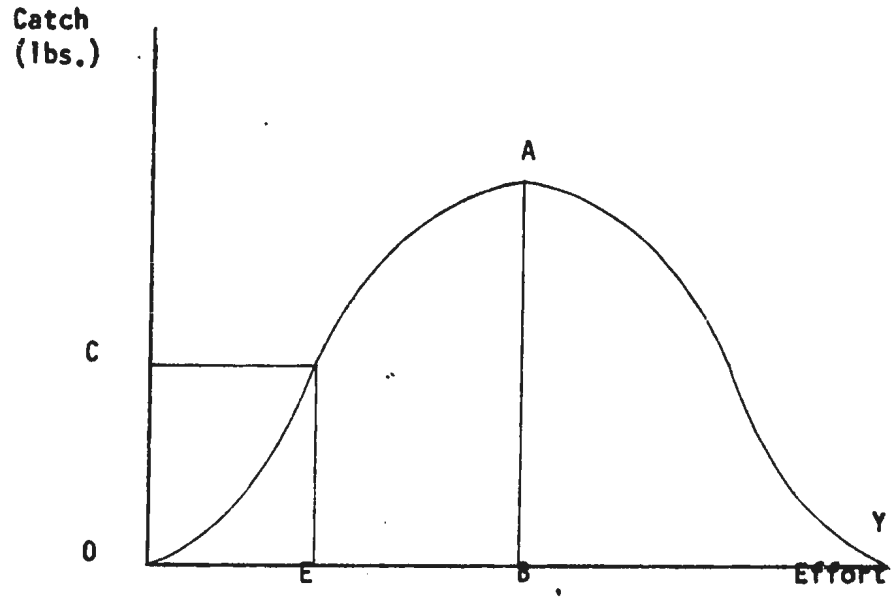
Under normal fishing conditions (i.e. without simultaneous adjustment of gear selectivity and fishing effort (5), the physical yield from any demersal fishery will increase at a low level of fishing as effort is increased, but the increase in physical yield will be at a decreasing rate. In effect the reduction in population and average weight is more than offset by natural reproduction. However, as effort continues to increase, physical yield will reach a maximum and then decline because the decreased population and average weight are not capable of sustaining the high level of harvest.

As effort continues to expand, the total catch will approach zero as an asymptote. In extreme cases, landings could be reduced to zero, but in a demersal fishery such as cod, this is unlikely for three reasons: (1) The vast reproductive powers of most demersal

species, and cod in particular, make extinction by man a virtual impossibility. (2) The decreasing size of fish with increasing effort allows the less than commercial-sized stock to escape ordinary fishing gears. (3) The cost element, to be dealt with in the next section, which makes biological, if not economic, extinction impossible in most demersal fisheries.

Figure 1 shows the typical yield function of a fishery characterized by the biological features just outlined (6).

Figure 1. Physical Yield Function of a Demersal Fishery.



Every point on the yield curve is one of equilibrium landings and of sustained physical yield. For example, at maximum population size, landings must be zero by definition: natural reproduction balances natural mortality and natural rate of increase is zero. At each level of effort, balance will be achieved between landings and natural increase when all environmental

forces have worked themselves out. Each level of effort, therefore, is associated with a given size of the population capable of supporting a certain sustained yield. At OE effort this sustained yield will be OC (Figure 1). This yield will range from zero at maximum population size to almost zero when population size is very small. At some intermediate level is the population size which can produce the maximum rate of natural increase (and landings). When fishing effort reaches that level the optimum biological equilibrium, maximum sustained physical yield, is attained. (OB in Figure 1).

11. Economic Equilibrium and Optimum of a Fishery

An economic model of a fishery is obtained by building revenue and cost elements into the function of physical yield just described. The following model is based on two simplifying assumptions. While these may not be indicative of actual conditions, they do make for ease of presentation. And they do not affect the theoretical conclusions drawn. It is assumed price does not vary with the size of the catch; the physical yield function is thus transformed into a total revenue curve. This is not an unreasonable assumption for a small fishery whose products are closely competitive with many others. For the Newfoundland cod fisheries this assumption appears valid enough.

The second assumption is that cost per unit of effort is constant. The total cost curve is thus a linear function and includes the opportunity cost of labour and capital. Because some minimum investment is necessary before any landings can be made, the

the variable total cost curve starts from a point above zero on the vertical axis (See Figure 2).

When the fishery is open to all, the level of fishing effort will expand to OZ (for the cost-effort relationship shown in Figure 2). At this point total costs, TZ, equal total receipts, OD. Average cost per unit of landings equals average revenue and there are no excess profits (7). At a lower level of effort excess profits (hatched area) would exist; other vessels and men would be attracted to the fishery until total costs and total revenues are again equal. At higher levels of effort (to the right of Z), total costs will exceed total receipts.

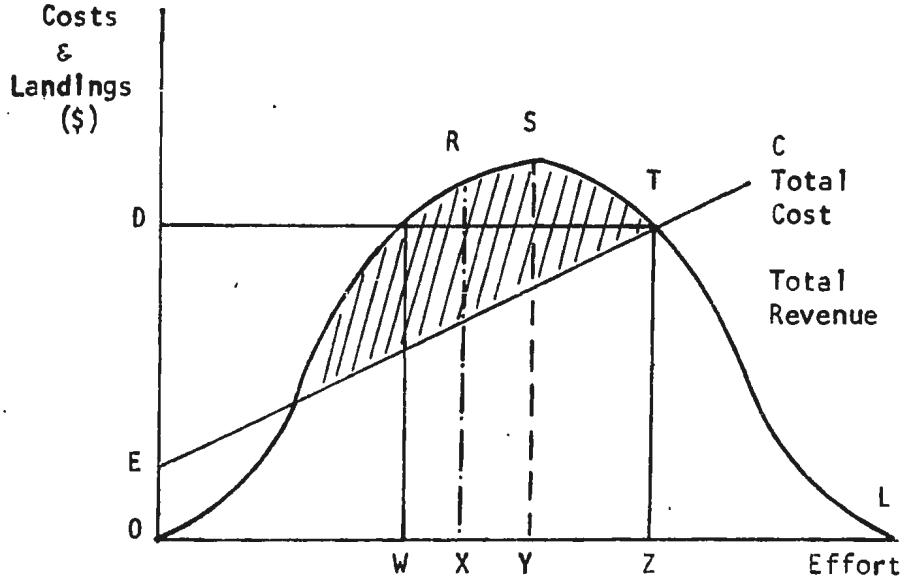


Figure 2. Interrelation of Total Costs and Total Revenue for a Demersal Fishery.

Vessels and men will then leave the fishery and normal vessel replacement will not be made. The level of effort will then move back to OZ and the fishery will be in equilibrium again. The level of effort could also change if prices of fish or costs of fishing changed. These cases are discussed below.

As Figure 2 shows, an unregulated fishery will lead to a lower sustained yield than could be achieved with a lower level of effort and cost (8). This maximum yield, SY, is attained at OY effort and cost. Such a situation (Point T) exists because the fish resource is not solely owned by any of the decision-making units (9). In other words, the rent (hatched area) cannot accrue to any individual operator (10). Since no one fisherman can obtain this rent, individual operators simply continue entering the fishery until all but necessary minimum profits are wiped out. This pushes effort up to the point where when the total cost curve cuts the total revenue curve, (T in Figure 2).

Therefore, rather than effort tending towards equating marginal cost and marginal revenue (Point R where the slopes of OL and EC are equal), it is expanded until average cost and average revenue are equated and all rent disappears. The individual fisherman tries to maximize his total revenue. He has no assurance of fish being available tomorrow if he does not catch it today. If entry to the fishery is unrestricted, any attempt to increase profits (rent) by reducing effort, collectively or individually, will simply induce more men and vessels to enter this fishery. Effort is then increased until all but necessary minimum profits are wiped out.

The situation shown in Figure 2 represents biological as well as economic overfishing (11). Maximum sustained physical and revenue yield is obtained at OY of fishing effort, where the yield

curve is at its highest point. The economic optimum will be even further to the left, OX, where the difference between total revenue and total cost is greatest. At this point, marginal cost equals marginal revenue (slopes of EC and OL are equal). At effort levels to the right of X, each unit of effort adds more to total cost than to total revenue. If effort were less than OX, more could be added to total revenue than to total cost by adding additional units.

Because the fishery is open, the equilibrium position (T) of Figure 2 is inevitable under the assumed cost-effort relationship.

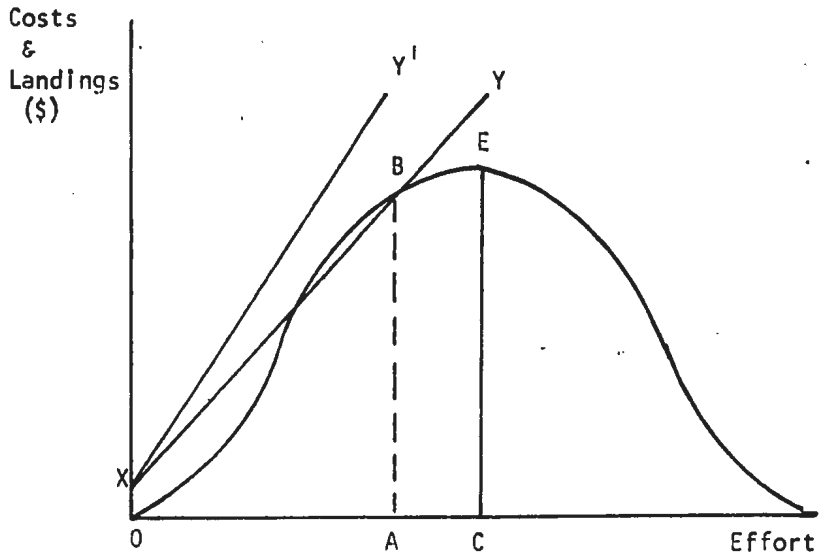


Figure 3. Case of a Fishery in Equilibrium below Maximum Yield and where no Commercial Operations Will Take Place.

However, other exceptional situations could occur as shown in Figure 3. If the market price fell or fishing costs rose, equilibrium could exist at OA effort and AB costs and revenue which are below the maximum physical and revenue yield, CE (12). The economic optimum would still be somewhere to the left of A. Also if the cost curve were to become so steep that no level of effort could produce revenue equal to costs, no economic

operation would take place. This case is shown by cost curve XY.[1]

(111) Biological-Economic Equilibrium

The conditions determining the biological and the economic equilibrium of a demersal sea fishery are such that, given time for all necessary adjustments, both equilibria for each level of population will be the same.

The conditions necessary for long term biological-economic equilibrium (13) may be restated more fully: Given the demand for the final product, the physical production function, and the costs of labour and capital used, equilibrium will be attained when:

(1) The price of the final product is such that amounts demanded and supplied are equal.

(2) At that price, net returns to fishing units are just sufficient to maintain the existing level of fishing effort (no excess profits exist).

(3) The catch at that level of effort is such that the population remains stable.

Any change in the basic determinants of population, yield, price or cost will involve interacting adjustments in both biological and economic factors until these conditions are again restored.

For example, if consumer demand rises, the resulting increase in price and profits will induce an increased effort and catch in the short run. This cannot be sustained as population will decline and costs per unit of catch increase. Equilibrium will be restored only at a higher level of fishing effort and total costs, where profits are again just sufficient to maintain the new level of effort (14).

Also if fishing costs per unit of effort should decrease, a similiar development will result. Profits increase, followed by increased effort and catch in the short run and a decline in price as these products reach the market. Again, however, this situation is unstable over time. The increased catch reduces population and increased fishing costs per unit of catch. The catch will eventually fall back from its initial increase as population changes and economic adjustments take place (15).

In both these examples of possible changes in the equilibrium position, the new equilibrium depends on the initial position of the fishery. If this were at or beyond the maximum revenue and physical yield, equilibrium will be restored only with a lower sustained catch, increased costs per pound of landings and higher short run market prices. Figures 4a and 4b shows the adjustments that will take place in a fishery beyond the maximum yield position when changes in fishing costs occur. If fishing costs decrease (through improvements in gear or vessels), there will be excess profits, (CX in Figure 4a), at the initial position. These profits will induce an increase in fishing effort and catch in the short run. The increased short-run catch will reduce prices for the product. This will tend to lower total revenue even before the long run adjustments begin to take effect. Finally, the increased short-run catch will reduce the fish population, resulting in a lower long-run sustained catch and increased total costs. The fishery will eventually become stable at OB effort after catch has fallen from AC to BD. Total costs will rise to BD after falling originally to AX. Therefore, the sustained catch will be lower and total costs higher than when the decrease in fishing costs first occurred.

As shown in Figure 4b, the reverse will occur if fishing costs increase when the fishery is beyond the maximum yield position. In the short run, losses (CX) will reduce effort and catch and raise market prices. Equilibrium will finally occur at OB effort. In this case a decrease (AB) in effort and a higher sustained catch (BD) results from the increase in fishing costs.

The long-run adjustments caused by a change in demand for a fishery below the maximum yield position are shown in Figures 5a and 5b.

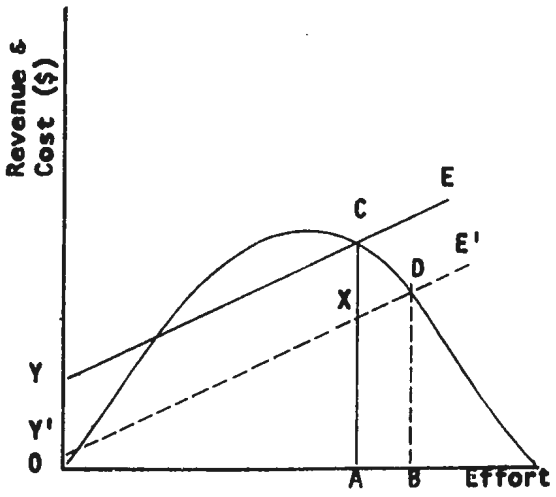


Figure 4a. New Equilibrium after Decrease in Fishing Cost (Fishery Initially Beyond Maximum Yield Position).

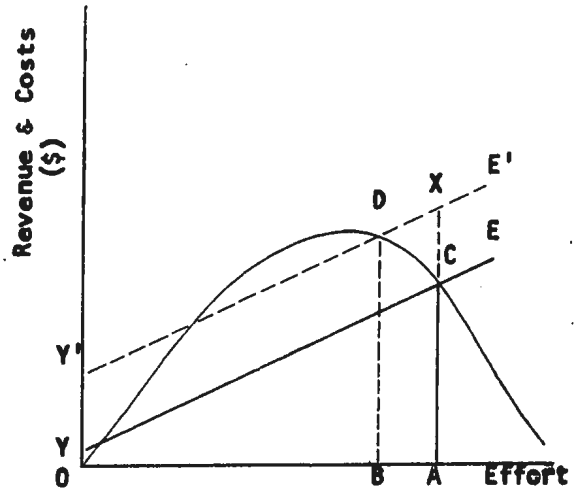


Figure 4b. New Equilibrium after an Increase in Fishing Costs. (Fishery Initially Beyond Maximum Yield Position).

A decrease in demand (Figure 5a) will reduce revenue and effort and eventually stabilize the fishery a lower level of effort (OB) and landings (BE). Conversely a rise in demand will lead to a new equilibrium with higher effort (OF) and increased landings (FH). See figure 5b.

In this discussion of biological-economic equilibrium we have made no mention of optimum positions. It should now be clear that, while a fishery will always tend toward a biological-economic equilibrium, the attaining of an optimum biological-economic position would occur only under some chance combination of costs and prices. The economic optimum will never be reached if entry to the fishery is unrestricted. Because

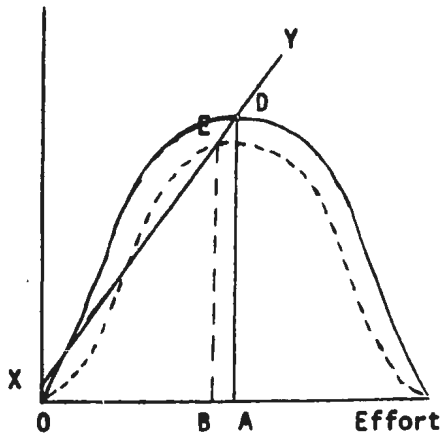


Figure 5a. Change in Equilibrium with a Decrease in Demand. (Original position below maximum Yield).

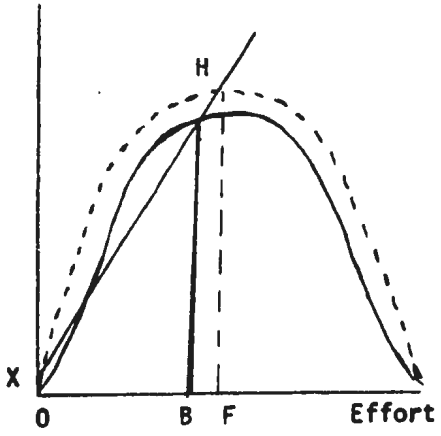


Figure 5b. Change in Equilibrium with an Increase in Demand (Original Position below Maximum Yield).

the optimum economic position occurs below the biological optimum at the point where marginal cost equals marginal revenue, an economic-biological optimum is possible only when the real (16) costs

of fishing are zero. This situation might be approached in a country with widespread unemployment, but this optimum can be dismissed as a goal for an economy near the full-employment level.

(1V) The Economic Optimum as an Objective

We have decided that the economic and biological optima are incompatible as objectives in developing or regulating a fishery. However, it should be pointed out that the biological optimum of maximum sustained yield is a better economic situation than that where the fishery is overfished which is often the result of free entry. Why then do we postulate net economic returns as the objective of a fishery?

The fishery as an industry, requires use of factors of production (labour, capital and management), which it purchases in competition with producers of other goods. As market prices may be reasonably taken as indicative of consumers' preference, the basic economic objectives of the fishery is the maximization of net economic yield - the difference between value of output and cost of input needed to produce it. The following conditions must be fulfilled if this is to happen (17).

(1) Assuming full employment, landings must rise to the point where the value of the last unit caught is just equal to its marginal real cost. In other words, the marginal revenue product of the factors used in the fishery should be equal that possible in alternative industries.

(2) The value of the last unit landed should equal the cost of the last input necessary to catch it. (Marginal cost equals marginal revenue).

(3) The incomes of the factors of production should equal their contribution to output.

Two other conditions may be necessary to maximize the profits of a fishery:

(1) Progressiveness: There should be sufficient competition so that incentives exist to adopt or develop new techniques and use methods developed elsewhere, where they increase revenue relative to cost.

(2) Stability: While perfect stability in production, price, and incomes is unlikely, the minimization of fluctuations in these is desirable.

While we accept this maximization of net value as the economic objective of a fishery, we do not imply that physical yields and their complex biological determinants are irrelevant or unimportant. They provide the information about alternative production possibilities without which catch values and fishing cost could not be determined.

While maximization of rent is obviously the economic optimum for a fishery, some argue this is not necessarily the human or social optimum (18). In principle, it is possible to take account of non-commercial or intangible benefits and costs in defining this optimum. For example, many people want the fishery to provide employment for as

many as wish to be so engaged. This desire could be translated into a benefit-cost analysis of the problem (19). Rent could, therefore, be made a social concept and the maximization of rent could be a socially and politically acceptable optimum. In any event, as Gordon points out, even if the economic optimum is not socially accepted, the recognition of it, shows the cost of alternative choices (20).

Whatever society's choice may be the achievement of the optimum degree of fishing is most difficult when entry is unrestricted. Even if entry were restricted, the amount of effort must also be controlled as individual actions of non-owners will not maximize rent. Establishment of private ownership has been advocated as the method of ensuring economic optimization of a natural resource (21). As this is an unlikely development in the Newfoundland cod fisheries, we only acknowledge it as a theroetical alternative.

Restriction of entry is the most widely advocated and increasingly accepted method of improving fisheries. We will not deal with it further as restriction on total effort is also necessary to achieve our economic optimum. We will now proceed to examine the Newfoundland fisheries more closely in the light of the principles outlined.

NOTES TO CHAPTER 111

(1) Gordon, H. Scott, "The Economic Theory of a Common Property Resource, the Fishery", Journal of Political Economy, April, 1955 pp 124-142.

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

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

(4) Schaefer, M.B., "Some Considerations of Population Dynamics and Economics in Relation to Management of Commercial Marine Fisheries", Journal of the Fisheries Research Board of Canada, Vol. 14, 1957, pp 672-675.

(5) With such an adjustment gear size is changed to catch a smaller and smaller average size of fish. Under such conditions total catch increases continually as effort is increased until presumably the whole stock is wiped out. Such adjustment usually is not made because fish below a certain size have no market value. See Beverton, R.J.H., & Holt, S.J. "On the Dynamics of Exploited Fish Populations", Ministry of Agriculture, Fisheries and Food, Fisheries Investigations, Series 2, Vol. 19 London, 1957, for a discussion at this concept called "eumetric fishing".

(6) Schaefer, M.B. op. cit., p. 674.

(7) Gordon, H. Scott, op. cit., pp 131-132

(8) Indeed, the same total revenue ZT could be had with a lower cost OW.

(9) Gordon, H. Scott, op. cit., p. 132.

(10) Rent here is profit over and above that needed to keep the factors of production in the fishery.

(11) Crutchfield, J.A. and Zellner, A. "Economic Aspects of the Pacific Halibut Fishery", United States Department of the Interior, Fisheries Industrial Research, Vol. 1, 1963, p. 15.

(12) Ibid., p. 15.

(13) Op. cit. 15.

(14) Ibid, cpt 15.

(15) Ibid., p. 16.

(16) In terms of other output foregone.

(17) Crutchfield, J.A. and Zellner, A., op. cit., p. 24

(18) Gordon, H. Scott, "An Economic Approach to the Optimum Utilization of Fishery Resources", Journal of Fisheries Research Board of Canada, Vol. X, 1953, p. 443.

(19) Christie, F.T., and Scott, A., The Commonwealth in Ocean Fisheries, Resources for the Future, Inc., Washington, 1965, p. 222.

(20) Gordon, H. Scott, op. cit., p. 443.

(21) Scott, A. op. cit., p.p. 120-123.

IV. Government and the Newfoundland Cod Fisheries

Before beginning our analysis of the inshore cod fishery we must examine government attention to this fishery. This attention is reflected in fishing regulations and development policy. The content of this chapter will, therefore, be wholly descriptive but is necessary to better understand the plight of the inshore cod fishery.

(1) Regulations in the Newfoundland Inshore Cod Fishery.

The inshore cod fishery is controlled by regulations made under the Fisheries Act, 1932. This act of the Canadian Parliament gave the federal Minister of Fisheries authority to make regulations in respect of all marine fisheries. The Newfoundland Fisheries Regulations are made under this Act, but many of these were simply carried over from pre-Confederation regulations.

The general regulations governing inshore cod fishing are contained in Sections 51 to 54 of the Newfoundland Fisheries Regulations. These may be summarized as follows:

The mesh in the sides and walls of a cod trap may not be less than $3\frac{1}{2}$ inches in "extension measure" (1) when in use. The mesh of a cod gill net must not be less than five inches in extension measure when in use. A cod bag (2) with less than $3\frac{1}{2}$ in. mesh may not be added to any part of the wall of a cod trap. However, a cod bag of any size mesh can be laced to the head rope of a cod trap.

The distance between cod traps or gill nets and other cod traps, cod nets, salmon traps or nets is also controlled.

A cod trap or its frame may not be set closer than 80 fathoms (3) from the nearest point of another cod trap or frame, or closer than 50 fathoms from any cod net, salmon net or salmon trap. Nor may a cod trap be set closer than 150 fathoms from a salmon trap, salmon net, or fleet of nets that measures over 50 fathoms in total length. A cod gill net may not be set closer than 50 fathoms to any cod trap, other cod gillnet, salmon net, or salmon trap. This restriction also applies to salmon nets and salmon traps.

The Regulations also contain general rules for cod trapping which apply in a certain area (4), the boundaries of which are set by the Minister upon receipt of a signed petition from two-thirds of the cod trap operators living in that area requesting establishment of a local codfishery committee.

This committee must be elected before the end of each February, or later if permitted, by the cod-trap operators, resident in the defined local area. The committee may consist of a chairman and two or four members. The committee must immediately set a date for the drawing of cod trap fishing berths or locations that is satisfactory to the majority of fishermen elegible to draw for berths in that area. To be elegible a fishermen must wish to operate a cod trap within the limits of the local area and be a resident of that area (5). However, if a person draws a cod trap berth and is issued a licence to fish it that year, but does not, he will not be elegible to participate in the drawing the following year, unless he can satisfy the authorities he was employed elsewhere or could not fish because of circumstances over which he had no control.

The local codfishery committee is responsible for the drawing of cod trap berths in its area. The drawing is conducted by lot in the following manner. The principal (prime) berths are firstly drawn. The number of berths in this draw must be equal to the number of persons operating at least one trap. No operator draws more than one berth in the first or any other draw. The draws continue in this manner until all traps are allocated to separate berths. A licence for each draw berth will then be issued to the various operators by the Federal Department of Fisheries.

The same crew cannot fish two traps drawn in the first round unless a berth is exchanged or becomes forfeited for re-allotment. Berths which were drawn and licenced may be exchanged with the approval of the majority of the local committee. If the drawer of a principal berth decides to fish with the drawer of another principal berth, both licences must be returned to the committee. The two berths must then be drawn again but the two original drawers may draw only one of the berths. In areas where traps must be set on or before a certain date any licenced berth holder who does not set his trap by that date, unless prevented by causes over which he has no control, forfeits his right to the allotted berth. His licence is then cancelled and the berth can be re-allotted to such person as the majority of the committee may decide. A berth may be similarly allotted if an operator removes his trap from a licenced berth during the season. However, if such a berth is not re-allotted four days after the licence is turned in, that berth may be fished for the remainder of that season by any other cod trap operator.

Only a licenced berth holder can fish any berth that has been drawn for in a year. An operator of a cod trap or of any other type of fishing gear may set his equipment in an unused licenced berth but must remove it if requested to do so by the committee for that area.

In areas of the Province not subject to the control of a local cod trap committee, a cod trap berth may be held by setting in position a complete trap or any part thereof (6). In the latter case, if a complete trap is not set within four days, any other cod trap operator may remove the set equipment and place his own in its place. The four day period referred to above does not include time when forces beyond the operator's control prevail. These berths are not forfeited by removing a damaged trap for repairs if it is reset within the four days described above.

The setting of cod traps is prohibited on the Harbour Grace Island grounds (7). Cod traps may not be set in one area of Fogo Island before noon on the first of June each year (8).

Any operator who does not haul his cod gill net for two consecutive days unless prevented by circumstances beyond his control forfeits his right to that fishing berth (9). A cod trap, cod net, salmon trap, or salmon net operator may remove any such cod nets and place his net or trap in its place.

Cod trawls and cod gill nets are prohibited in the Petty Harbour-Maddox Cove area (10). Cod trawls are also prohibited for July 1 to October 31 on the inshore grounds used by Fermeuse fishermen (11), and on those used by Renews fishermen (12).

(11) A Review of Government Fishery Policy

To discover what the two levels of government, provincial and federal, have done, we shall look at the Commission of Government and post-Confederation periods. Of course, federal participation in development plans came only since 1949, and then in a few well defined areas of responsibility.

During the Commission of Government period, 1934 to 1949, the government's fishery policy was mainly directed toward the establishment of orderly marketing arrangements for fish products, especially salted cod. The Newfoundland Fisheries Board was created as a result of a study of the industry's problems by a Fisheries Investigation Committee shortly after the Commission of Government was established (13).

Under the Newfoundland Fisheries Board Act, 1936 (with amendments), the Board was given wide powers to licence processing plants, regulate marketing, inspect plants and products, provide a bait service and other assistance.

The Board's major activity was concerned with the processing and marketing of salted cod. Board representatives were stationed in the major markets to advise on conditions affecting sale of Newfoundland salt fish. Culling Regulations were enacted in 1939 to encourage production of good quality fish by fishermen (14). These regulations were enforced by Board inspectors at the time of sale by fishermen to exporters.

The Board also gave exclusive rights to export and sell salted fish in certain markets to marketing companies. This system began in 1936

with the formation of the Portugal Exporters Group Ltd. (15). By 1943 the following were in operation: (16)

The Portugal Exporters Group Ltd.

Spain Exporters Association Ltd.

Puerto Rico Exporters Ltd.

West Indies Codfish Association

Brazil Exporters Ltd.

These groups made all arrangements for export and sale of Newfoundland salt fish to their own market area. During the war years 1942-45, and until 1947, the Board handled arrangements with the Combined Food Board and later the International Emergency Food Council in respect of Newfoundland's fish production (17). In 1947 it organized the Newfoundland Association of Fish Exporters Ltd. (NAFEL) and gave that association sole authority to export salted fish from Newfoundland (18).

In years of declining market prices for salted fish, such as 1938 to 1941, the Board administered schemes to keep prices to fishermen at least equal those of the previous year. In 1938 and 1939 minimum prices to fishermen were maintained by the government's making good losses experienced by exporters (19). A similiar procedure was followed in 1940 and 1941 but any losses were paid from a fund created by a levy on salted and pickled fish exports (20).

The Board also influenced the cost of salt to fishermen. In 1937 and 1938 a rebate was paid on each hogshead of salt used (21). From 1942 to 1945 the Board controlled the price of salt to fishermen by paying the difference between the landed cost and the price paid by importers (22).

A bait service was started in 1936 with the aim of providing a constant supply of bait at a fixed low cost (23). Bait depots were established around the coasts to assemble and hold stocks of the bait fishes for use by fishermen.

A subsidy was also available for construction of trawlers and draggers under the Ship Building (Bounties) Act, 1939.

Following Confederation the federal government took over operation of the bait service. Since 1949 the service has grown to include 19 bait depots and 36 holding units and a bait freezer ship.

Confederation also brought to Newfoundland the federal subsidy which applied to the construction of draggers and longliners up to 100 feet long (24). The Fishermen Indemnity Plan afforded low-cost protection from losses of fishing boats and lobster traps and was extended in 1966 to include certain types of fixed gear. The Industrial Development Service of the federal Department of Fisheries has carried out projects designed to test and demonstrate technological innovations for improvements of catching, processing or distribution of fish and fish products. From 1955 to 1967 the federal government paid a rebate on salt used in the fishery. The direct assistance expenditures (net) of the federal Department of Fisheries since 1949 are shown in Table 1.

However, it is the provincial government that has prime responsibility for the development of the Province's fisheries. Following Confederation the resources of the federal Treasury could be tapped by Newfoundland, and little time was lost in making financial assistance available to the fishery.

TABLE 1

FINANCIAL ASSISTANCE EXPENDITURES IN NEWFOUNDLAND

BY THE FEDERAL DEPARTMENT OF FISHERIES

BY TYPE, BY FISCAL YEAR, 1949-50 TO 1966-67

Fiscal Year	Bait Service	Salt Rebate	Vessel Construction Subsidy	Fishermen's Indemnity Plan
	($)	($)	($)	($)
1949-50	287,771	-	-	-
1950-51	323,222	-	-	-
1951-52	284,046	-	-	-
1952-53	285,897	-	-	-
1953-54	263,220	-	6,828	-
1954-55	225,450	-	90,489	91,651
1955-56	237,448	289,881	41,646	61,231
1956-57	239,445	364,165	10,352	65,580
1957-58	284,964	406,441	25,825	61,179
1958-59	632,249	339,379	1,135	64,220
1959-60	505,903	414,193	34,013	65,275
1960-61	444,406	497,475	19,170	63,862
1961-62	449,569	349,028	66,157	65,254
1962-63	607,693	397,605	36,398	69,624
1963-64	1,650,143	369,316	42,850	68,398
1964-65	827,429	316,924	247,422	76,100
1965-66	603,044	304,774	119,008	84,067
1966-67	699,726	301,411	302,744	182,316

Source: Annual Report of the Canada Department of Fisheries, 1949-50 - 1966-67, Queens Printer, Ottawa.

Note: Expenditures for the Bait Service and Fishermen's Indemnity Plan are net after revenues.

In 1953, the Newfoundland Fisheries Development Authority, a crown corporation was established. It has been concerned mainly with the improvement and development of fishing and production methods. To help fishermen it is mainly involved in conducting experiments and demonstrations in fishing methods, construction of multi-purpose boats and in the exploration of new fishing grounds. Many of these projects are carried out on a shared-cost basis with the federal Department of Fisheries.

Through the provincial Fisheries Loan Board, loans are made available to fishermen for the construction and purchase of larger fishing vessels capable of a variety of fishery operations and hopefully larger production. Loans were also made available to purchase better engines and fishing gear. By the end of 1966 over 1,600 loans amounting to some $3.4 million had been made by the Board (25).

Further aid to fishermen for acquiring larger boats was made available under the Fishing Ships (Bounties) Act, 1955, which replaced the Ship-building (Bounties) Act, 1939. This aid amounts to $160 per ton on newly constructed vessels and can be received in addition to the federal subsidy. Financial assistance for maintaining and prolonging the life of existing vessels was provided by the Fishing and Coasting Vessels Rebuilding and Repairs (Bounties) Act, 1958. From 1949 to 1966 bounties totalling $2.2 million had been paid on 387 vessels (26).

In 1962 the provincial government instituted an Inshore Fisheries Assistance Programme, which provides a maximum bounty of $10 a foot on boats measuring from 24 to 35 feet and pays bounties to fishermen

on certain types of nylon and other snythetic fibre nets and trawl lines. The amounts paid to March 31, 1968 under this Programme are shown in Table 2.

In the early part of the 1960's the provincial government intensified its efforts to provide financial assistance to the industry. The College of Fisheries, Navigation, Marine Engineering and Electronics was established to create a trained fishing labour force. In 1963 the federal government was urged by Newfoundland to adopt a national fisheries policy, which would involve an annual expenditure of $15.5 million ($10.5 million federal, $5 million provincial) in Newfoundland over five years (27). In its 1965 election platform the government proclaimed a plan that would modernize and expand the fishing industry to double its present size (28). These schemes failed to materialize.

In addition to these distinguishable expenditures by federal and provincial governments there are others which cannot be easily documented in dollars terms. For example, the Federal Department of Public Works spends several million dollars annually for construction, maintenance, and repair of marine structures that are used by the fishing industry. From 1958 to 1967 a programme of constructing "community stages" was financed jointly by the federal and provincial governments.

In addition to the provincial loan service, there is a federal one operated under the Fisheries Improvement Loan Act. Little use has been made of this service by Newfoundland fishermen.

TABLE 2

FINANCIAL ASSISTANCE TO PRIMARY FISHERIES EXPENDITURES BY NFLD. GOVERNMENT, BY TYPE, AND BY FISCAL YEAR, 1949-50 TO 1966-67

Fiscal Year	Vessel Construction Bounty ($)	Vessel Repair Bounty ($)	Inshore Boat Bounty ($)	Inshore Gear Bounty ($)	Experimental Fishing ($)
1949-50	84,321	-	-	-	-
1950-51	38,637	-	-	-	59,615
1951-52	68,945	-	-	-	47,093
1952-53	63,311	-	-	-	12,099
1953-54	52,464	-	-	-	35,320
1954-55	41,505	-	-	-	37,954
1955-56	37,421	-	-	-	69,360
1956-57	30,359	-	-	-	36,723
1957-58	25,915	-	-	-	38,144
1958-59	33,610	73,150	-	-	62,032
1959-60	68,402	77,008	-	-	17,216
1960-61	57,833	32,106	-	-	103,260
1961-62	80,641	32,771	-	-	212,406
1962-63	212,980	77,114	-	-	106,059
1963-64	252,811	34,999	31,476	208,963	100,641
1964-65	240,016	27,391	105,396	286,196	109,005
1965-66	196,767	36,612	83,356	288,471	241,138
1966-67	243,821	17,311	65,086	370,277	497,799

Source: Public Accounts of the Province of Newfoundland, 1949-50 to 1966-67.

NOTES TO CHAPTER 1V

(1) This is defined in Section 2 (g.a.) of the Regulations as "the distance between the extreme angles of a single mesh measured inside and between the knots after the twine has been saturated in water and extended until taut but without straining or breaking the twine or slipping a knot".

(2) A cod bag is a mesh bag used to hold cod after removal from the trap.

(3) This distance may be less if so requested by local cod fishery committees. These are discussed in the next paragraph.

(4) The rules are contained in Sections 54 to 63. Special regulations may also be made for a local codfishery committee's area. For examples see: Note 3 above and Note 5 below.

(5) The qualifications may be made stricter in certain areas like St. John;s where dependence for a living on cod trapping, ownership of trap(s) and five years residence are required.

(6) "Newfoundland Fisheries Regulations", Section 65.

(7) Ibid., Section 67.

(8) Ibid., Section 69 (a)

(9) Ibid., Section 66

(10) Ibid., Section 69 (c)

(11) Ibid., Section 69 (d)

(12) Ibid., Section 69 (e)

(13) Department of External Affairs & Dominion Bureau of Statistics, Newfoundland, an introduction to Canada's New Province, Ottawa 1949, p. 84.

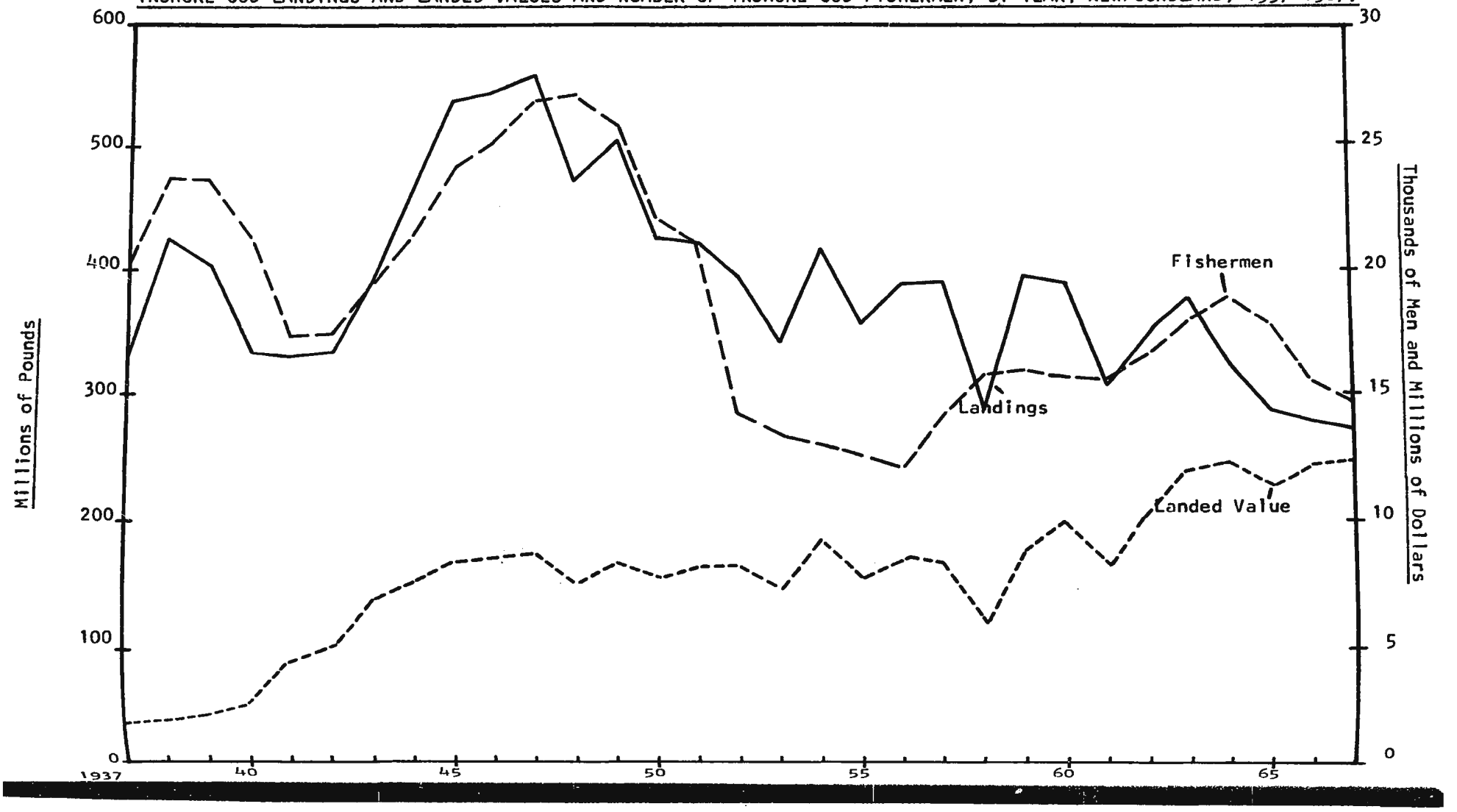
(14) Report of the Newfoundland Fisheries Board, 1939-1940, Department of Natural Resources, St. John's, 1941, P. 17. These Regulations were repealed in 1959.

(15) Report of the Newfoundland Fisheries Board, 1947, Department of Natural Resources, St. John's, 1948, p. 10.

(16) Report of the Newfoundland Fisheries Board, 1945, Department of Natural Resources, St. John;s, 1947, p. 7.

CHART 1

INSHORE COD LANDINGS AND LANDED VALUES AND NUMBER OF INSHORE COD FISHERMEN, BY YEAR, NEWFOUNDLAND, 1937-1967.



(17) Report of the Newfoundland Fisheries Board, 1947, Department of Natural Resources, St. John's, 1948, p. 10.

(18) Ibid., pp. 10-11. NAFEL lost the legislative sole right to export in 1957.

(19) Report of the Newfoundland Fisheries Board 1937-38, Department of Natural Resources, St. John's, 1940, p. 33. Report of the Newfoundland Fisheries Board, 1939-40, Department of Natural Resources, St. John's, 1941, pp. 16.

(20) Ibid., p. 33

(21) Report of the Newfoundland Fisheries Board 1938-39, Department of Natural Resources, St. John's, 1940, p.p. 18 and 37.

(22) Report of the Newfoundland Fisheries Board 1945, Department of Natural Resources, St. John's, 1947, p. 18.

(23) Department of External Affairs and Dominion Bureau of Statistics, Newfoundland, An Introduction to Canada's New Province, Ottawa, 1949, p. 87.

(24) "The Fisheries of Canada", reprints from the Canada Year Book, 1949-50 to 1966-67.

(25) Young, Ross, "Newfoundland's Imaginative Fishery Development Programme", Book of Newfoundland, Vol. 3, 1967, p.424

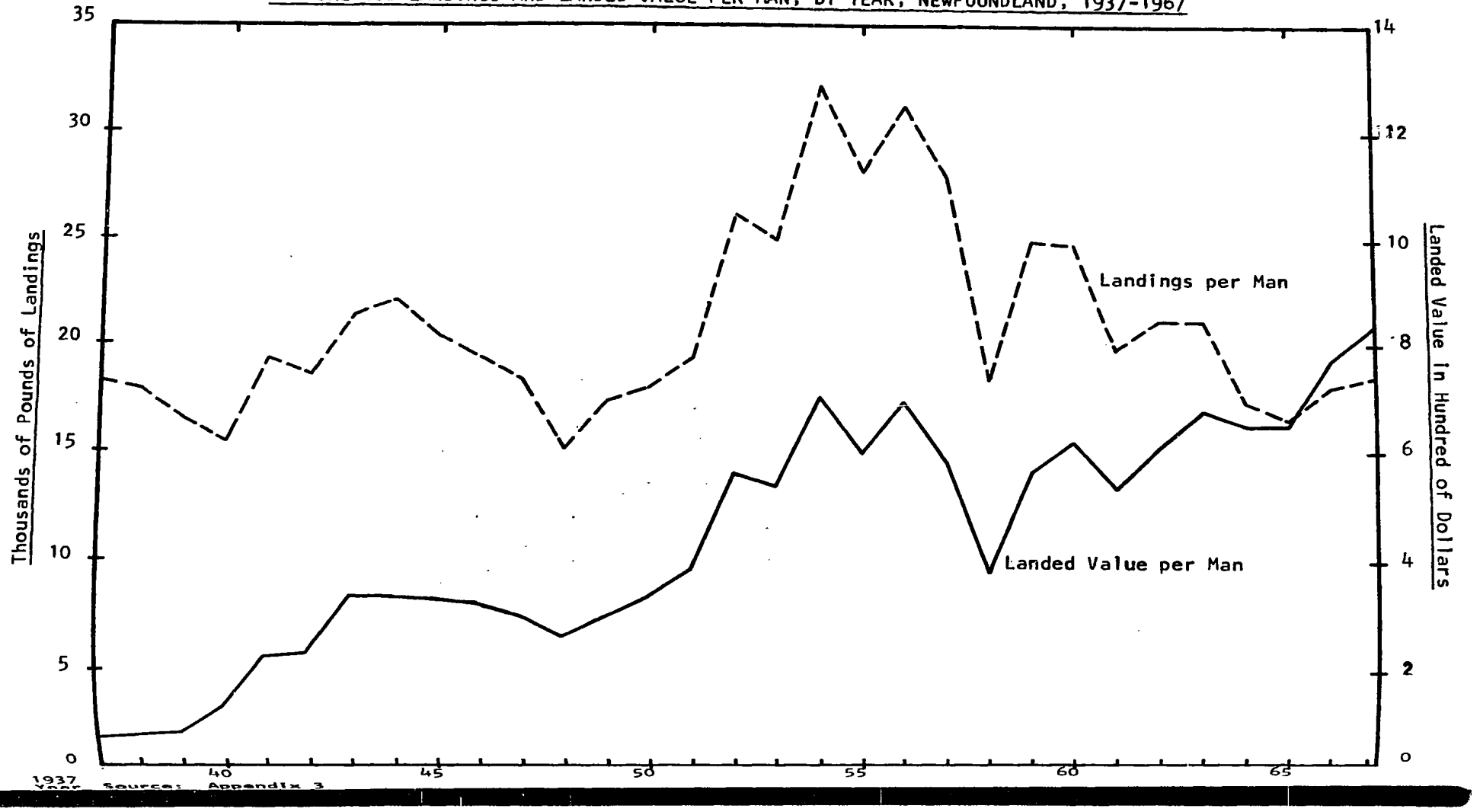
(26) Ibid., p.425

(27) National Fisheries Development, a presentation to the Government of Canada by the Government of Newfoundland, St. John's, 1963, pp 10-11.

(28) Building New Highroads to a Better Life, a Publication of the Government of Newfoundland and Labrador, St. John's, 1965, p. 23.

CHART 2

INSHORE COD LANDINGS AND LANDED VALUE PER MAN, BY YEAR, NEWFOUNDLAND, 1937-1967



Source: Appendix 3

V. The Newfoundland Inshore Cod Fishery

The relative importance of cod to the fisheries of Newfoundland and its role in the inshore fishery has been mentioned elsewhere. We shall now examine the performance of the inshore cod fishery since 1937, and analyse its problems in the light of the biological and economic theory described in the previous two chapters. The results of various programmes directed towards the Province's fisheries and especially those affecting the inshore cod fishery will be discussed. Finally, we shall offer an explanation why past plans have not solved the problems of the cod fishery.

(1) The Performance of the Inshore Cod Fishery since 1937.

By 1936, the inshore cod fishery had almost completely recovered from the effects of the Great Depression: men were continuing to re-enter the fishery. Landings had reached a peak of 524 million pounds in 1934 (1). The downward trend in landings which began in 1936-37 was accelerated in 1939-40 because the War drew men away from the fishery. (Appendices 1 and 2 and Chart 1). Both employment and catch fell until 1942. Thereafter the demand for Newfoundland fish began to rise leading to increased employment of fishermen. The catch began to increase due to rising prices for fish. The end of the War in 1945 was an extra boost to the fishery as most European fleets had been destroyed and because the excellent demand for Newfoundland fish continued. More men were now available to the fishery (2) and the number engaged rose steadily until 1948. However, in the late 1940's the fishery was beset by declining market

prices for salt cod (3). The trend of catch and employment began a decline in 1949. With interim upward fluctuations, this downward trend had continued until the present.

Several factors, which will be described below, are responsible for the declining catch over the last 20 years. Also, the number of men engaged has been influenced by several factors, which are set below.

While the total inshore cod catch and numbers of fishermen have shown a steady decline since 1937, the average annual catch per man fluctuated without any noticeable trend emerging (See Appendix 3 and Chart 2). The average catch declined from 1937 to 1940, rose until 1945 and fell again until 1948. From 1949 until 1954-56 the average catch increased, and thereafter showed a general decline except for upward movements in 1959 and 1960.

It is interesting to note that the average catch has usually moved in opposite directions to the total number of inshore cod fishermen. In periods of increasing entry of fishermen, 1937-39, 1942-48 and 1956-64, the average cod catch decreased. In periods of decline in the numbers of fishermen, 1939-42, 1948-56, and 1964-67, the catch per man increased. From this we may conclude that, over time, this fishery is subject to declining marginal physical productivity while at certain times the marginal productivity was negative (4).

While the volume of the inshore cod catch has fluctuated since 1937, the landed value has increased fairly constantly (See Appendix 1 and Chart 1). Until the mid 1950's the trend in landed value followed that of volume. After 1957-59, the decline in the landed weight was more than compensated by the increased landed value per pound (See Appendix 4).

Because most of the inshore cod catch was salted until 1965, prices paid fishermen for the salted product had the greater influence on landed value up to that time. However, the influence of the freezing industry became more and more important as it grew and utilized an increasing percentage of total cod landings (See Table 3). This second demand for cod landings became dominant in 1965-66 and the trends in landed volume and value began to show distinct divergencies. The effects of this competition for cod landings were very evident in 1967. In that year freezing companies were first affected by declining market prices for frozen cod products. However, the demand for salted fish continued good and fishermen received prices for this product that were equal to or better than these received the previous year. Even though freezing plants used less cod in 1967 they had to maintain prices to fishermen because of the competition from the salted fish sector. In 1968, markets for salted fish also deteriorated and prices to fishermen for both fresh and salted cod fell from 1967 levels.

TABLE 3

PERCENTAGE UTILIZATION OF COD LANDINGS, NEWFOUNDLAND, BY YEAR, 1953 TO 1967

Year	PERCENT OF COD LANDINGS USED FOR				
	Fresh Dressed and Fillets	Frozen Fillets and Blocks	Salted	Canned	Non-Food Uses
1953	1.25	14.30	84.16	0.08	0.21
1954	0.98	19.45	78.37	0.02	0.18
1955	1.78	26.28	70.74	0.05	0.15
1956	1.50	25.52	72.88	0.06	0.04
1957	2.31	25.24	72.23	0.13	0.09
1958	3.44	34.63	61.78	0.06	0.09
1959	2.57	31.38	65.35	0.07	0.63
1960	2.46	27.95	69.49	0.04	0.06
1961	3.55	36.09	60.26	0.01	0.09
1962	4.06	33.68	62.08	0.05	0.13
1963	4.01	36.48	59.38	0.03	0.10
1964	3.73	41.65	54.35	0.01	0.26
1965	2.85	50.87	45.96	0.02	0.30
1966	3.40	50.70	45.30	0.02	0.58
1967	2.67	36.96	60.19	-	0.18

Source: Department of Fisheries of Canada, Economics Branch, St. John's, Newfoundland.

Although there is no marked trend in average landed volume over the last 31 years, the average landed value has shown a steady increase except for some fluctuations. See Chart 2 and Appendix 3. The average landed value is also inversely related to the number of inshore cod fishermen. From 1938 to 1942, the numbers of inshore cod fishermen declined while the average landed value increased. The reverse was true from 1942 to 1948. In the period 1948-56, the number of men decreased, while the average landed value increased. Since 1957 the average landed value rose (except for 1958) but the number of inshore cod fishermen increased until 1964 and has fallen since. Between 1956 and 1967 the decline in average landed volume was more than offset by increased average prices for cod landings as described on page 48.

While the number of inshore cod fishermen has declined between 1937 and 1967, it is quite possible that the amount of effort expended in this fishery has increased. While fishing effort is most difficult to define and measure, some general statements about its amount can be made. The number of trawl-lines, gill-nets, and hand-lines used increased after 1954 (Table 4). The number of cod traps in use declined from 1935 to 1957; increased until 1965 thereafter decreasing by some 600 in 1967.

The number of motor boats in use increased between 1954 and 1965 but declined slightly in 1966 and 1967 (Table 5). During the same period, the Labrador floater fleet (5) had increased, but declined somewhat in the last two years. However, in the past several years

TABLE 4
NUMBER OF GIVEN TYPES OF FISHING GEAR USED
IN THE INSHORE COD FISHERY, NEWFOUNDLAND, BY YEAR
1935, 1945, 1954, 1956 TO 1967

Year	Cod Traps	Trawl Lines	Gill Nets	Handlines
1935	5,285	--	9,463	--
1945	5,084	--	8,385	--
1954	2,726	106,633	--	17,477
1955	--	--	--	--
1956	2,590	105,476	3,283	17,262
1957	3,061	121,098	2,065	22,071
1958	3,371	137,103	2,285	23,994
1959	3,370	132,656	2,411	24,548
1960	3,675	124,302	3,763	26,933
1961	3,806	139,520	3,667	27,208
1962	4,088	135,938	6,737	28,216
1963	4,089	149,138	14,736	31,463
1964	4,380	150,442	23,648	28,937
1965	4,508	151,826	29,526	29,634
1966	4,041	142,971	29,805	28,334
1967	3,938	138,345	38,560	24,402

-- Not available

Sources: (1) Tenth Census of Newfoundland and Labrador, 1935. Vol. 11, Department of Public Health and Welfare, St. John's, 1937.

(2) Eleventh Census of Newfoundland and Labrador, 1945. Vol. 11, Dominion Bureau of Statistics, Ottawa, 1949.

(3) Report on Men, Boats and Gear Employed in Primary Operations, Newfoundland, 1957, 1958, 1959, 1960, 1961, 1962, 1963, 1964, 1965, 1966, and 1967, Economics Branch, Canada Department of Fisheries, St. John's, Nfld.

TABLE 5
NUMBER OF INSHORE VESSELS, BY TYPE, FISHING COD, NEWFOUNDLAND, 1937 - 1967 (1)

Year	Small Motor Boats	Longliners	Labrador Floaters	Other (2)	Total
1937	--	-	375	94	--
1938	--	-	293	117	--
1939	--	-	286	90	--
1940	--	-	251	59	--
1941	--	-	197	51	--
1942	--	-	162	24	--
1943	--	-	215	24	--
1944	--	-	227	33	--
1945	--	-	227	45	--
1946	--	-	192	49	--
1947	--	-	179	54	--
1948	--	-	131	35	--
1949	--	-	144	35	--
1950	--	--	65	24	--
1951	--	--	28	-	--
1952	--	4	25	-	--
1953	--	9	18	-	--
1954	7,518	14	2	-	7,534
1955	--	14	-	-	--
1956	6,979	13	-	-	6,992
1957	7,797	15	-	-	7,812
1958	8,530	25	4	-	8,559
1959	8,700	51	2	-	8,753
1960	9,073	56	7	-	9,136
1961	9,411	47	16	-	9,474
1962	10,102	58	31	-	10,191
1963	10,811	85	36	-	10,932
1964	11,391	112	48	-	11,551
1965	11,573	129	59	-	11,761
1966	11,210	198	42	-	11,450
1967	10,916	266	45	-	11,227

-- Not available

Notes: (1) Defined as vessels under 25 gross tons. However, Labrador floaters include vessels over 25 gross tons; they are classified as inshore because the floater vessel is not the catching unit, but rather a carrying vessel.

(2) This category includes small schooners under 25 gross tons which were reported as part of the deep-sea fleet prior to 1951. After that they are tabulated as small motor boats, Labrador Floaters, and longliners.

Sources: (1) Annual Reports of the Newfoundland Fisheries Board and General Review of the Fisheries, 1937 to 1948, Department of Natural Resources, Nfld. Fisheries Board, St. John's.

(2) Report on Men, Boats and Gear Employed in Primary Operations, 1954, 1956 to 1967, Economics Branch, Department of Fisheries of Canada, St. John's, Nfld.

this fishery has been prosecuted by an increasing number of longliners, which are better equipped than the traditional floater vessel. The most significant change in effort has been the rapid increase in the number of smaller longliners since 1960. These boats are much more expensive and better equipped than traditional open motor boats and, therefore, account for greater average fishing effort.

The value of capital equipment employed in the inshore cod fishery has steadily increased since 1954, the first year for which such data are available (Appendix 5). The most significant increases have taken place after 1962. The data for these years support the contention that effort is increasing because some of the newer capital is more efficient.

The value of capital equipment per inshore cod fishermen has also increased considerably over this period, see Appendix 6. With an increase in the capital/labour ratio, an increase in output per man is normally achieved. But, as we have already pointed out, the landed volume per man did not increase, whereas rising prices caused the average landed value to increase. Moreover, the landed volume and landed value produced per dollar of capital has fallen since 1954, indicating declining physical and value output for inshore capital. (Appendix 7).

(11) <u>The Problem of Entry</u>

There is no legal restriction (6) on entry to the Newfoundland inshore cod fisheries. Any person owning a boat and some fishing gear is free to engage in cod fishing. If he does not

own a boat and/or fishing gear, he may join with other men for an agreed share of the catch.

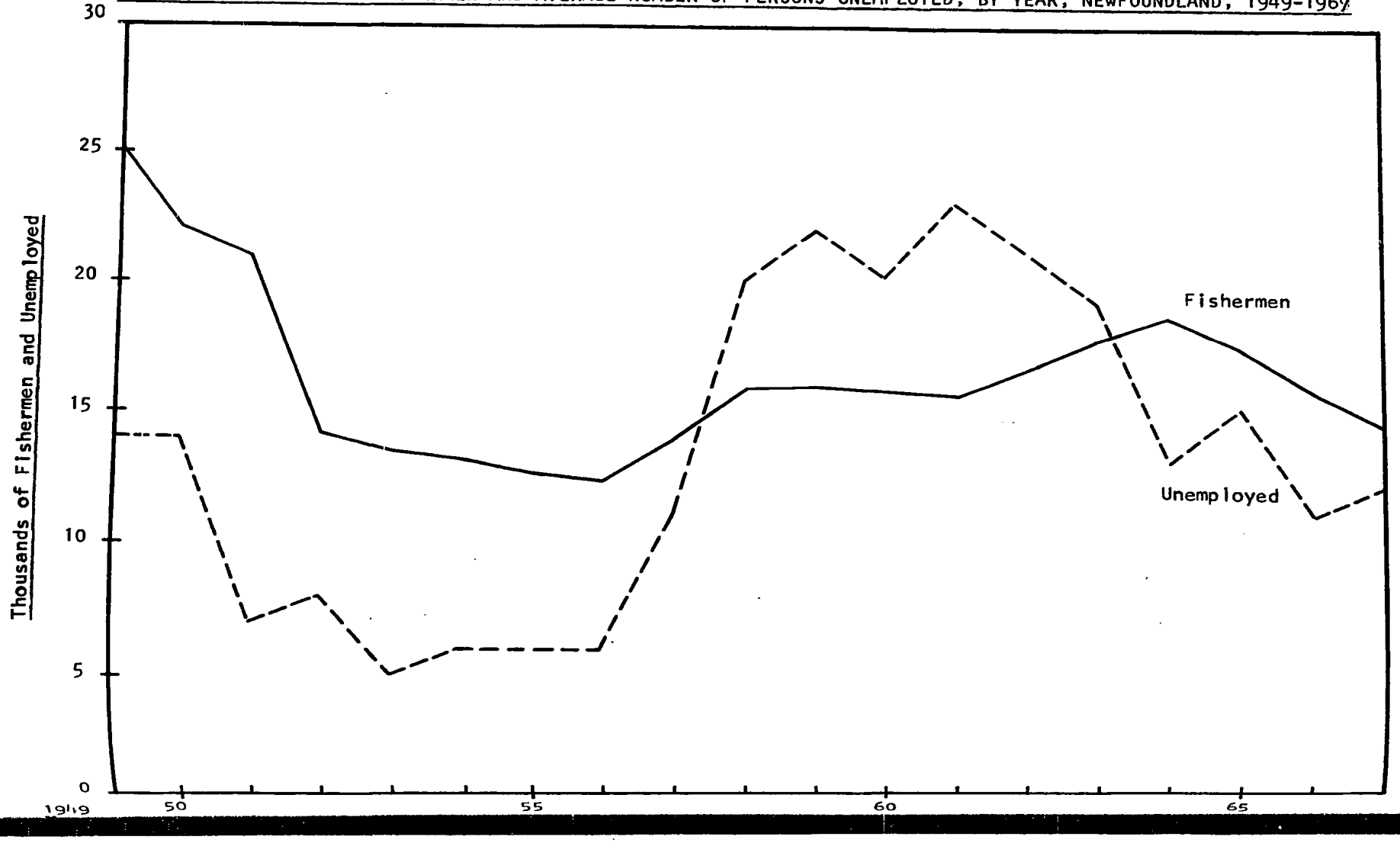
The trend in the numbers of inshore cod fishermen has already been described. We also have pointed out that periods of rising average value and declining numbers of fishermen have been followed by periods when the opposite occurred. Both the average catch and numbers of fishermen increased from 1962 to 1965 but thereafter fishermen declined in numbers while the average landed value rose. Information is not available on these trends in 1968.

This increasing entry when returns (7) are rising is similiar to the situation of excess profits described in the economic theory of a fishery. While the total number of men recovered somewhat in each period of increasing entry, the trend has been downward over time. However, each time this cycle occurred, more and more capital was brought into use. We have stated on page 51 this means increased effort has been exerted on this fishery despite the long run decline in numbers of men. If the price per pound of landings had not increased, the revenue yields from the fishery would have been much lower. The "constant dollar" landed value has moved downward in the last few years as shown in Appendix 8.

While increasing returns have influenced trends in entry, the average level of unemployment has probably played a more significant role. This is the claim made by Copes (8), among others, in respect of the Newfoundland fisheries.

CHART 3

NUMBER OF INSHORE COD FISHERMEN AND AVERAGE NUMBER OF PERSONS UNEMPLOYED, BY YEAR, NEWFOUNDLAND, 1949-1967



As shown in Chart 3, in the period 1949-56 there was a downward trend in the level of unemployment as well as in the numbers of inshore cod fishermen, while average landed value was increasing. Over the next five years there was an upward movement in the unemployment level and in the numbers of fishermen, but average landed value remained fairly constant. From 1962 to 1967 the level of unemployment again showed a downward trend; the number of men engaged rose until 1964 and has fallen since then. On the other hand during the last six years average returns have increased; the largest increase was after 1965. These facts thus indicate that alternative employment opportunities have somewhat more effect on entry than changes in average returns. It is likely, therefore, that many men earn less than their opportunity cost in cod fishing when employment levels are rising.

Other factors also have an influence on the number of fishermen in general and cod fishermen in particular. These include government policy announcements, isolation, lack of education and the psychology of the fishermen. They could have specific or momentary effects, for example, government policy announcements. Or they could have an absolute, or continuing effect as in the case of isolation, education levels and psychology.

To illustrate the effect of government policy announcements we shall use the most obvious examples since Confederation. In 1951 the Provincial Government, during the election campaign, proclaimed a great "Industrial Development Revolution". Fishermen were told; "Burn your boats." The following year the number of inshore cod fishermen decreased

about 6,500. This decline in numbers has not been reversed even though little came of the industrialization programme.

In 1962, amidst much fanfare, the Provincial Government proclaimed a fisheries development policy, which it presented to the federal government. The numbers of fishermen began increasing rather rapidly, perhaps in anticipation of improvements in the fishery (9). However, by 1965 nothing concrete had come of this programme and a decline in numbers of fishermen again set in.

The early colonization policy of the British government resulted in a proliferation of small communities along the entire coast of Newfoundland. The isolation of many of these settlements was a hard fact until recent years. In these locations fishing was, and remains, the only major source of employment. Removed from the regular labour market by this pattern of settlement, many men are held in the fishery even when other jobs are available. In the last five years road building and the Resettlement Programme have worked to remove many communities from the isolation of the past. However, even today some communities are still relatively isolated and the effect on numbers of fishermen is not yet completely eliminated.

The lack of education has an effect on fishing manpower similiar to that of isolation. Low education levels prevent many fishermen from obtaining jobs in the regular labour markets even when knowledge of these opportunities is available. It also could be a stumbling block to improvement in productivity by preventing the adoption of new fishing methods. The College of Fisheries, Navigation,

Marine Engineering and Electronics should eliminate most of this second effect over time.

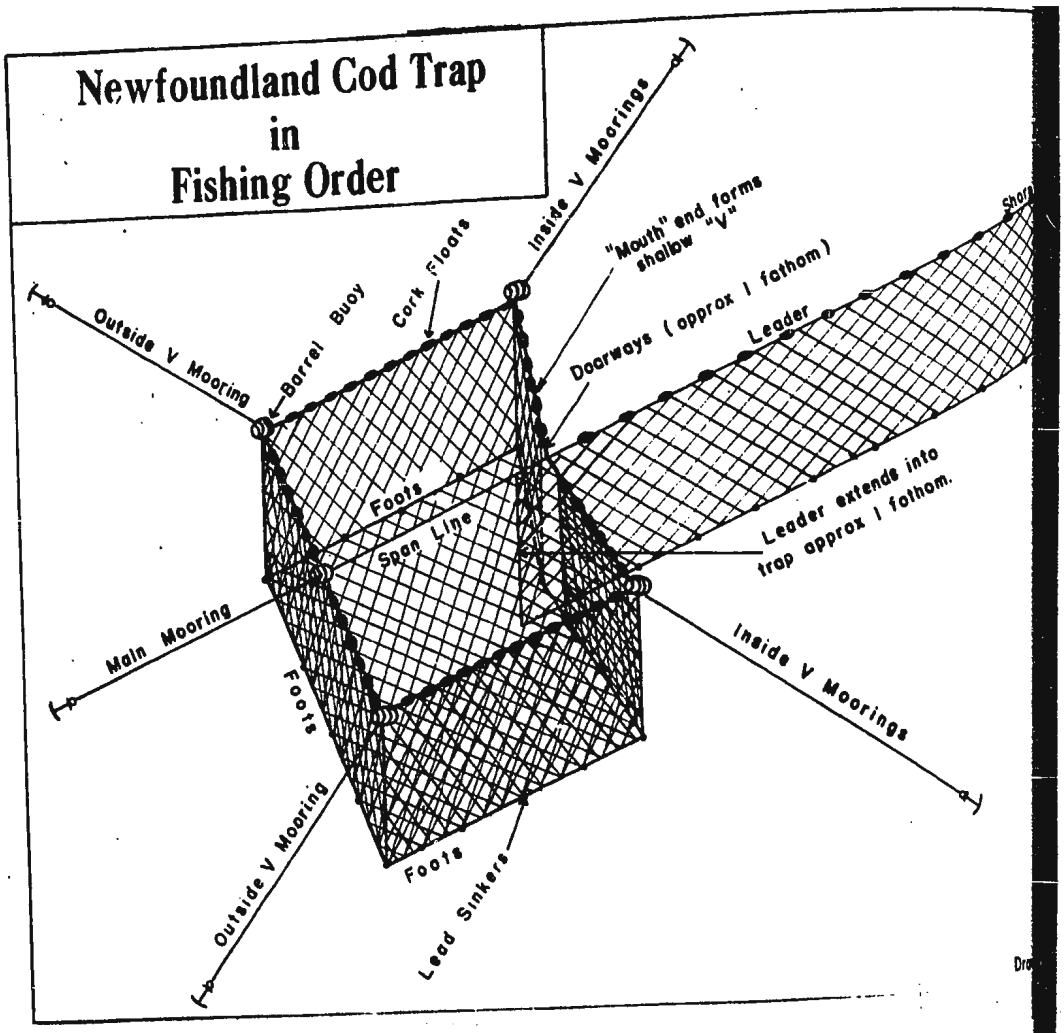
Fishermen as a breed have particular psychological characteristics which cause them to remain fishing through bad years as well as good. Most fishermen are emotionally or romantically tied to the sea. Fishing has probably been a family tradition for many generations. In addition, they are gamblers but incurable optimists always looking for the good catch next year (10). All these factors tend to hold men in the fishery even in the absence of isolation, lack of education, etc.

The problem of entry to the inshore codfishery is, therefore, a very complex one. While entry is relatively unrestricted, outward movement is hindered by several forces. Any development programme designed to improve average returns through reduction of numbers must consider all factors which influence entry to, or exit from the inshore cod fishery (11).

(111) <u>The Problem of Technology and of the Resource.</u>

Technology used in the inshore cod fishery and the resource base will be discussed together because in most fisheries the one can affect the other. The technology could be very efficient resulting in a quick depletion of a resource. Or the resource could have certain characteristics such as size or movements that make exploitation by certain technologies difficult or uncertain thus preventing economic utilization.

The technology used in the Newfoundland inshore cod fishery has changed little since 1937. The fishing gear has consisted of various


Newfoundland Cod Trap
in
Fishing Order
Inside V Moorings
"Mouth" end forms shallow "V"
Outside V Mooring
Barrel Buoy
Cork Floats
Doorways (opprox 1 fathom)
Leader
Foots
Span Line
Leader extends into trap opprox 1 fathom.
Main Mooring
Inside V Moorings
Foots
Outside V Mooring
Foots
Lead Sinkers

combinations of cod traps, trawls or longlines, handlines, jiggers, and gill nets. Except for gill nets there has been little change in these fishing gears. The first gill-nets were made of cotton; around 1960 nylon was introduced. In the last two or three years an increasing number of monofilament gill nets are being used.

Each of these gears are basically immobile. Excluding handlines and jiggers, they must be set in the water and left for periods varying from hours to a day before hauling. Cod traps are the most immobile for because of their size and shape they cannot be moved as quickly as trawls or gillnets (12). See Figure 4. While handlines and jiggers are not fixed gear, they are not very efficient catching tools.

The principal inshore cod gears (13), traps, trawls or longlines and gillnets, do not move with the boat as in the case of otter trawls. They are set in the water to wait for the cod. Only in recent years has fish finding equipment influenced the use of longlines and gill-nets.

Until the early 1950's, the main fishing craft was the open motor boat, usually less than 30 feet long. Its operation was restricted by its small size, lack of power and of seaworthiness in rough weather. There was no mechanical aids to navigation except the compass, no electronic fish finding equipment, and no mechanization of fishing gear such as powered gurdies. The open motor boats, therefore, compounded the immobility of the fishing gears used.

Shortly after Confederation a new type of boat called the longliner, or trap boat longliner, was adopted and modified from the Cape Island-type craft of the Maritimes. These craft range in length

from 35 to just over 50 feet. Diesel engines give more speed; power gurdies make the setting and hauling of gear quicker and less labourious. Electronic equipment such as radar, radio-telephone, and fish finders enable these vessels to venture farther from land and makes for more effective hunting of fish. Longliners being larger than motor-boats, are more seaworthy and the enclosed working areas can make fishing relatively comfortable.

Various studies (14) have indicated that this type of vessel provides higher average crew earnings than the open motor boat. The small longliner appears to have increased fishing activity in such cases as the Bay de Verde fishery outside Baccalieu Island and the Twillingate fishery some 20-25 miles from land. But this type of vessel is still relatively little used in the Newfoundland inshore cod fishery. Even though these vessels require less labour because of mechanization, only 798 men fished for cod in this type of craft in 1967, while the motor-boat fleet was crewed by 13,572 cod fishermen (Table 6). Several reasons for the limited adoption of this type vessel can be advanced.

These craft are expensive compared with the cost of the smaller motor-boat. Original costs range from $10,000 to $30,000 or more (15). Even with a government subsidy, many fishermen, no doubt, find the cost prohibitive. The prospect of paying off a loan on such a vessel is not a pleasant one considering the general low and variable returns from fishing. As MacFarlane points out, a fisherman is notoriously slow to adopt new techniques; this constitutes a

TABLE 6

NUMBER OF INSHORE (1) COD FISHERMEN ON GIVEN TYPES OF BOATS

BY YEAR, NEWFOUNDLAND, 1937-1967

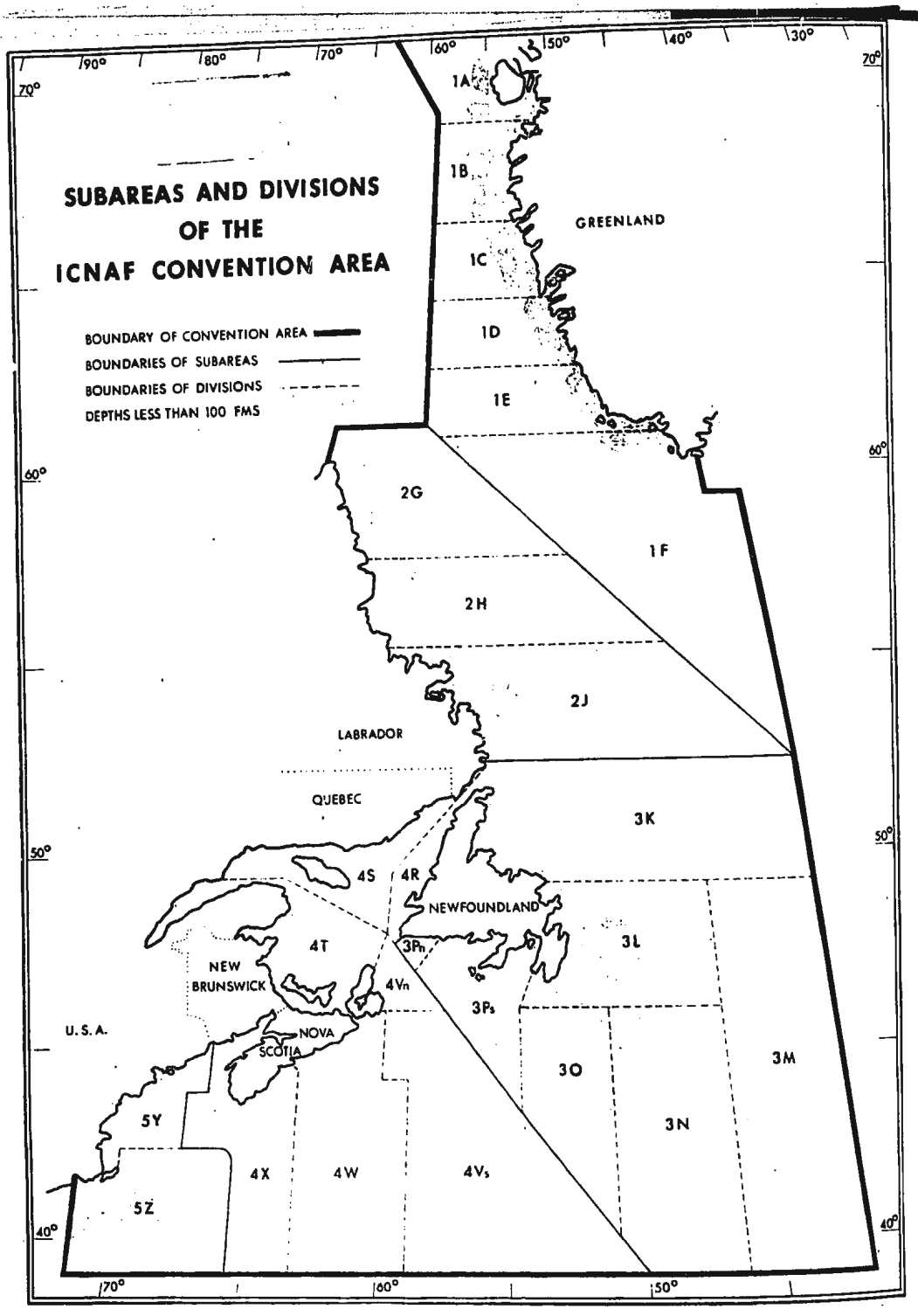
Year	Small Motor Boats	Longliners	Labrador Floaters	(2) Other	Total
1937	17,444	-	2,500	490	20,434
1938	20,852	-	2,440	529	23,821
1939	20,834	-	2,333	429	23,596
1940	19,058	-	2,029	286	21,373
1941	15,217	-	1,746	254	17,217
1942	15,758	-	1,500	105	17,363
1943	17,213	-	1,832	108	19,153
1944	19,363	-	1,873	150	21,386
1945	21,895	-	1,902	201	23,998
1946	23,229	-	1,629	209	25,067
1947	25,010	-	1,521	220	26,751
1948	25,595	-	1,140	155	26,890
1949	22,170	-	3,388	100	25,658
1950	--	--	2,050	70	22,050
1951	--	--	1,850	-	20,850
1952	13,959	12	227	-	14,198
1953	13,239	27	167	-	13,433
1954	12,927	42	44	-	13,013
1955	12,602	42	-	-	12,560
1956	12,186	39	-	-	12,199
1957	13,808	45	-	-	13,853
1958	15,575	75	43	-	15,693
1959	15,629	153	18	-	15,800
1960	15,390	168	63	-	15,621
1961	15,268	141	144	-	15,553
1962	16,072	174	277	-	16,523
1963	17,058	255	340	-	17,653
1964	17,801	336	483	-	18,620
1965	16,527	387	476	-	17,390
1966	14,561	594	425	-	15,580
1967	13,572	798	347	-	14,717

-- Not available

Notes: (1) Defined as men fishing on boats under 25 gross tons.
(2) See Table 5.

Sources: (1) Annual Report of the Newfoundland Fisheries Board and General Review of the Fisheries, 1937 to 1948, Department of Natural Resources, Newfoundland Fisheries Board, St. John's.

(2) Report on Men, Boats and Gear Employed in Primary Operations, 1954, 1956 to 1967, Economics Branch, Canada Department of Fisheries, St. John's, Nfld.


SUBAREAS AND DIVISIONS
OF THE
ICNAF CONVENTION AREA
BOUNDARY OF CONVENTION AREA
BOUNDARIES OF SUBAREAS
BOUNDARIES OF DIVISIONS
DEPTHS LESS THAN 100 FMS
GREENLAND
LABRADOR
QUEBEC
NEWFOUNDLAND
NEW BRUNSWICK
NOVA SCOTIA
U. S. A.
1A
1B
1C
1D
1E
1F
2G
2H
2J
3K
3L
3M
3N
3O
3Ps
3Pn
4R
4S
4T
4Vn
4Vs
4W
4X
5Y
5Z
70°
60°
50°
40°
90°
80°
30°
20°

paradox in his gambling nature (16).

Certain conditions for profitable utilization of longliners have been stated by the writer elsewhere (17). They include more distant fishing grounds, the need for greater carrying capacity, and the possibility of fishing later into the season. Usually these conditions have been met wholly or partly where longliners have been most successful. Consider the Port de Grave fishermen using longliners to prosecute the cod-trap fishery around Cape St. Francis. However, many cases of low utilization have been found to exist. This larger craft is used to fish grounds usually covered by motor boats but the catch is no larger. As mentioned on page 59 some increase in fishing on more distant grounds has resulted from the use of longliners. However, in only a few cases, have these craft moved to other areas where fish were more plentiful than on the home grounds.

Thus, the cost of new capital, unsuitability to some areas, slow adoption by fishermen, as well as lack of education and low returns from fishing all contribute to the small change in technology in this fishery. The effectiveness of the present fishing methods on the resource will be discussed in the following pages.

Unfortunately, data on cod catches by type of gear are available only for the years 1964 to 1966 for the following ICNAF Divisions 3K, 3L, 3Ps, 3Pn and 4R. See Figure 5. These Divisions cover landings around the Newfoundland coast and along the coast of Labrador from Blanc Sablon to Cape St. Charles. The data also include landings by all longliners over 25 tons which are statistically defined

Chart 4

Monthly Distribution of Cod Landings
by Cod-Traps, 1964-66 Averages, Nfld.,
ICNAF Divisions 3K, 3L, 3Ps, 3Pn, and 4R.

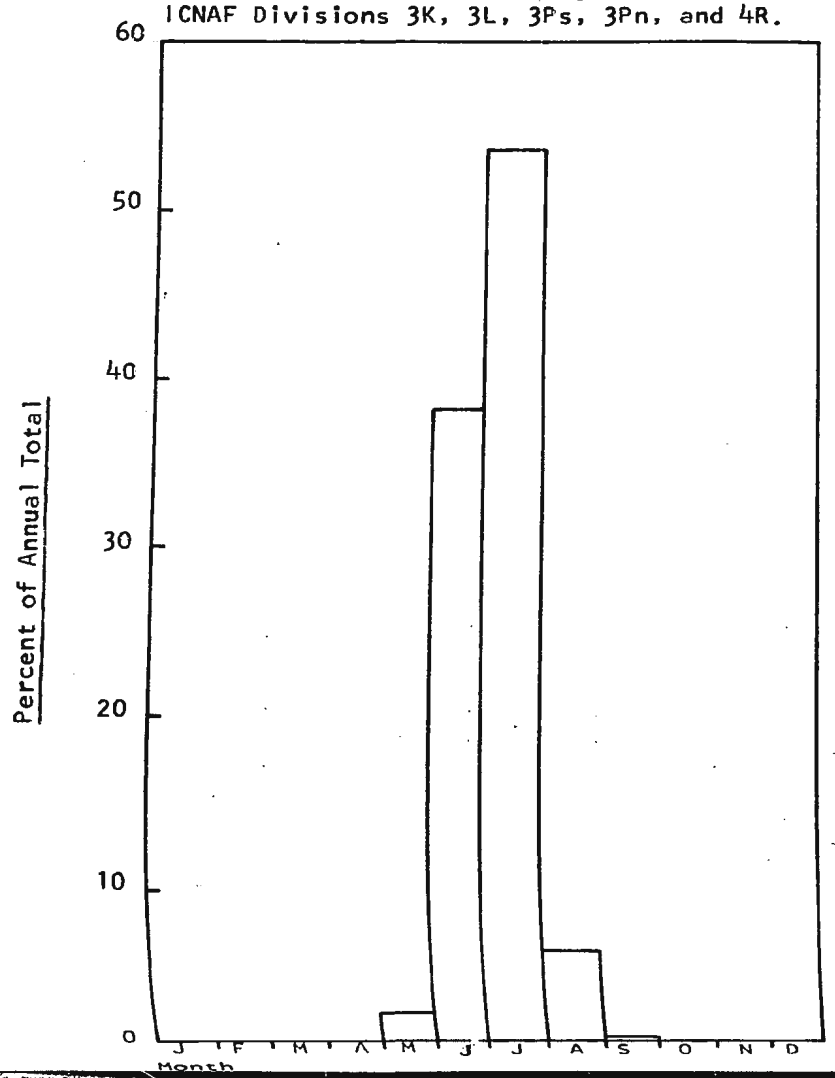
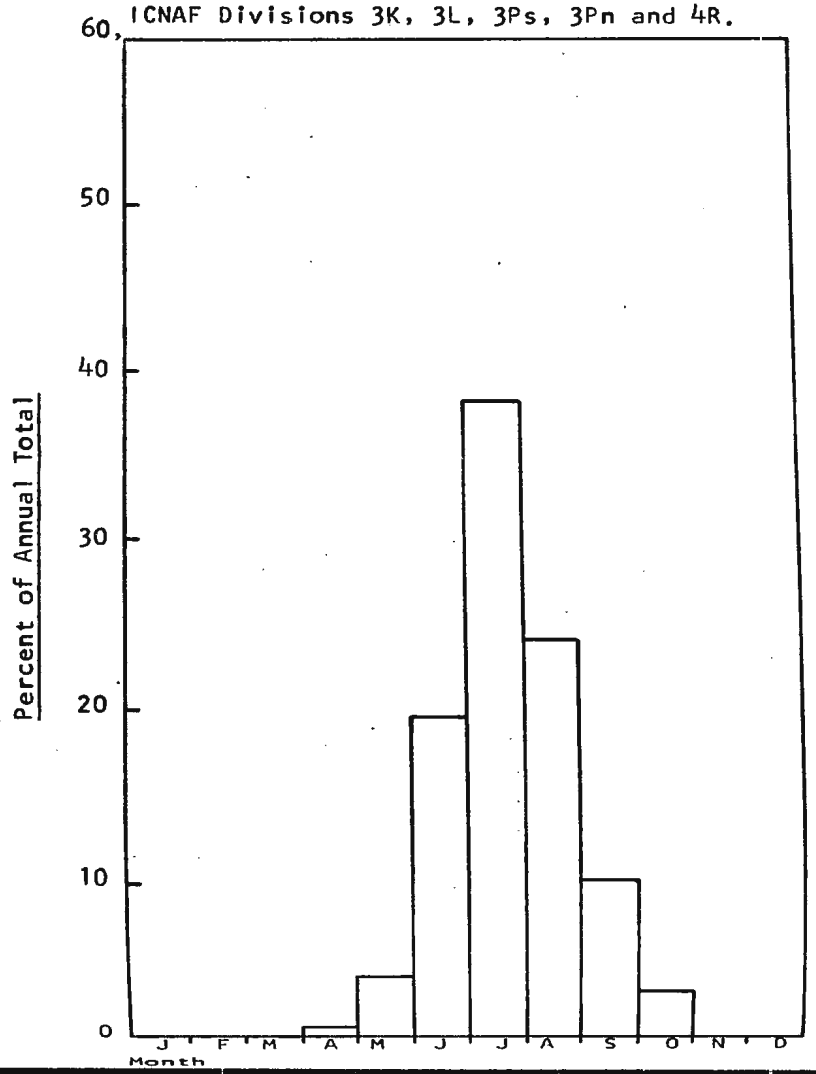


Chart 5

Monthly Distribution of Cod Landings
by Gill Nets, 1964-66 Averages, Nfld.,
ICNAF Divisions 3K, 3L, 3Ps, 3Pn and 4R.



as offshore vessels. The landings of these vessels are such they do not distort seasonal landings by inshore gears but simply raise the overall percentage of cod landings by longlines. These Divisions also exclude northern Labrador where the cod trap is the most important type of inshore cod fishing gear. This depresses the percentage of landings taken by this type of gear. Allowing for these factors, the effectiveness of the inshore gears may be illustrated.

The cod trap is the most important gear in the inshore cod fishery in terms of amounts landed. However, its use is very seasonal: Cod trap landings are made in a period of four months, May to September (18). Over 90 per cent of the annual landings by cod-traps are taken in June and July. See Table 7 and Appendices 9, 10 and 11 as well as Chart 4. In these two months this gear produces the greatest percentage of the monthly cod landings as shown in Table 8 and Appendices 12, 13 and 14. Despite its importance, the cod-trap appears to be producing a declining annual catch. See Appendices 15, 16, and 17.

The cod trap is such a major producer because it is ingenously designed to trap the cod when theycome close to shore while following the caplin (19). However, this very characteristic also contributes to the seasonality of this gear. When the cod move off from the land in late July and early August, the cod trap cannot be used in the deep water. Indeed, the cod would unlikely be trapped at that time because it generally becomes sluggish after feeding on caplin. The declining catches by cod traps are due to the increased offshore fishing effort

TABLE 7

MONTHLY INSHORE[(1)] COD LANDINGS BY TYPE OF GEAR AS PERCENT OF ANNUAL TOTALS, ICNAF DIVISIONS, 3K, 3L, 3Ps, 3Pn AND 4R

1964-1966 AVERAGES

Month	Total Catch	Caught By					
		T	GN	HL	J	LL	Unknown
January	0.6	-	-	Ø	0.4	2.0	1.5
February	1.6	-	-	Ø	1.1	5.6	1.2
March	1.9	-	Ø	-	0.8	6.5	1.8
April	2.2	-	0.6	0.1	0.6	6.6	13.6
May	3.6	2.1	4.0	Ø	6.4	5.3	20.3
June	22.4	38.0	19.7	21.0	22.2	7.8	2.1
July	33.7	53.7	38.3	21.3	31.1	10.7	1.2
August	16.4	6.1	24.0	33.3	22.2	15.9	3.4
September	10.0	0.1	9.9	20.1	9.0	18.9	2.8
October	5.2	-	3.0	3.7	4.9	14.2	3.9
November	1.8	-	0.4	0.3	0.4	5.2	22.3
December	0.7	-	Ø	Ø	1.0	1.3	25.8
Amounts ('000 lbs.)	320,487	105,018	85,630	27,992	10,192	88,421	3,234

T - Cod Trap, GN - Gill Net, HL - Handline, J - Jiggers, LL - Longline and/or Trawl Line.

Ø = Less than 0.1 percent.

Note: (1) Inshore here includes all boats under 25 gross tons plus all Longliners over 25 gross tons.

Source: Appendix 18

TABLE 8
(1)
PERCENTAGE OF MONTHLY INSHORE COD LANDINGS TAKEN BY TYPE OF GEAR, ICNAF DIVISIONS, 3K, 3L, 3Ps, 3Pn AND 4R, 1964-1966 AVERAGES

Month	Total Catch ('000 lbs.)	Percent Taken By T	GN	HL	J	LL	Unknown
January	1,838	-	-	0.6	2.2	94.6	2.7
February	5,111	-	-	0.2	2.2	96.9	0.7
March	5,955	-	0.6	-	1.3	97.1	1.0
April	6,920	-	7.9	0.5	0.8	84.4	6.4
May	11,556	18.7	29.5	0.1	5.6	40.3	5.7
June	71,881	55.5	23.5	8.2	3.1	9.5	0.1
July	107,897	52.3	30.4	5.5	2.9	8.8	Ø
August	52,641	12.1	39.1	17.7	4.3	26.7	0.2
September	32,012	0.3	26.6	17.6	2.9	52.3	0.3
October	16,772	-	15.1	6.1	3.0	75.1	0.8
November	5,756	-	5.7	1.4	0.7	79.6	12.5
December	2,148	-	0.9	0.2	4.7	55.3	38.8
Totals	320,487	32.8	26.7	8.7	3.2	27.6	1.0

T - Cod Trap, GN - Gill Net, HL - Handline, J - Jiggers, LL - Longline and/or Trawl Line.

Ø = Less than 0.1 per cent.

Notes (1) Inshore here includes all boats under 25 gross tons plus all longliners over 25 gross tons.

Source: As per Table 7.

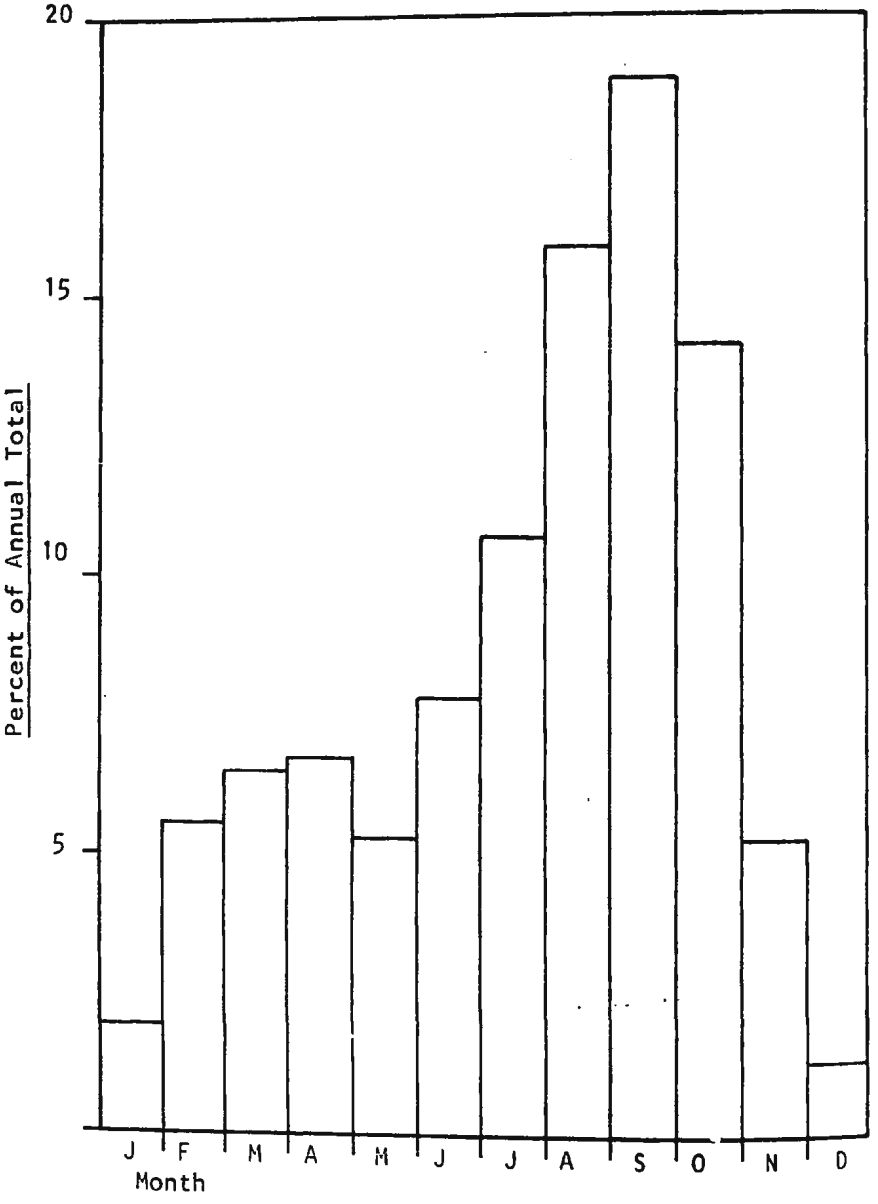
which is reducing the numbers of fish migrating within the reach of this gear (See Page 14). Indeed, Templeman appears rather pessimistic about future landings from cod traps (20).

In recent years gillnets have somewhat supplemented the amount of cod taken by cod traps. The use of gill nets has been encouraged by a 50 per cent subsidy instituted by the Provincial Government in 1962. This type of gear catches the larger, older fish which are not taken by cod-traps. The gill net does not produce as great a quantity of fish, but does have a longer operating period than the cod trap. The gill net can take cod from March to December but the amounts taken in these two months are insignificant. Over 80 per cent of annual landings by this type of gear are made in the period June to August. See Chart 5. It is the major catching unit for the month of August only. While landings from gillnets have been increasing over the last few years, this trend will likely be reversed when the stock of fish now taken by gillnets is reduced in average size (21). The gillnet has the following advantages over the cod trap: it can catch cod in the deeper water to which they move in late July or early August; it can also be used to fish other species, notably turbot, whereas the cod-trap takes virtually nothing of commercial importance but cod.

The longline, or line trawl, is the third major fishing gear used in the cod fishery, and appears to be the most consistant producer. See Chart 6. While the data somewhat overstates the importance of this gear to the inshore fishery, its seasonal pattern

Chart 6

Monthly Distrlcution of Cod Landings by Longlines, 1964-66 Averages, Newfoundland, ICNAF Divisions 3K, 3L, 3Ps, 3Pn and 4R



Source: Table 7

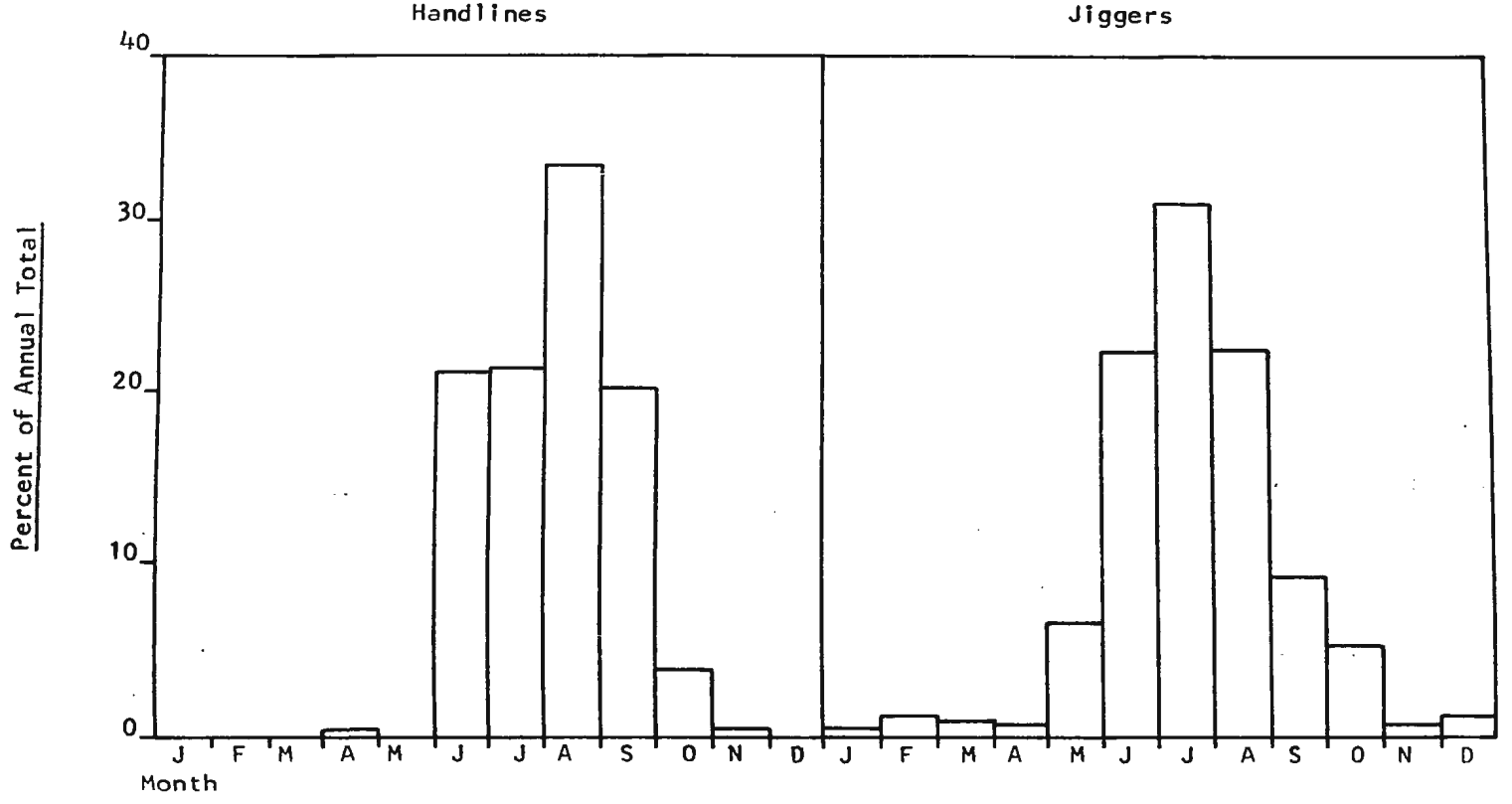
is not really affected. The longline is most important before and after the trap fishery. It is the major catching unit each month from January to May and from September to December. From July to October approximately 60 per cent of the annual landings by longlines are made. However, the landings by this gear also appear to be declining. This is due mainly to the fact that longlines are being partly replaced by gill nets and a decline in the numbers of fish available to longlines. The latter factor is likely to be even more significant in the future (22).

Handlines and jiggers are minor types of cod gear, catching about ten per cent of the annual cod landings. The handline is the more seasonal of the two, catching about 95 per cent of its annual landings from June to September. See Chart 7. Some landings by jiggers are made in all months, with about 75 per cent of the gear's annual total being taken from June to August. The two gears do not account for the greatest percentage of landings in any month. These gears are completely manual and in most cases are used as a complement to another type of gear. They are an unimportant part of the inshore catching technology.

The catching gears of the Newfoundland inshore cod fishery are essentially dependent on the behaviour of the cod for success or failure. They lack the element of pursuit, which is characteristic of otter trawls, the mainstay of the deepsea fleet. Cod traps are efficient when the cod is near the shore, but are of no use when the

Chart 7

Monthly Distribution of Cod Landings by Handlines and by Jiggers, 1964-66 Averages, Newfoundland, ICNAF Divisions, 3K, 3L, 3Ps, 3Pn, and 4R.



Source: Table 7

inshore waters cool and the fish move off into deep water. Gillnets and longlines can catch fair quantities at this time. The gillnet, however, is dependent upon fish of a certain size. The longline is also dependent upon large fish to some extent, but is even more dependent for its catches upon the amount of natural food available to the cod and upon a constant supply of bait. The last statement is also true of handlines and jiggers.

All the above gears are dependent upon the amount of fish that comes into coastal waters each year. In turn, this amount, whether in numbers, size, or absolute weights, is affected by the amount of fish caught in offshore waters by larger fishing vessels from Canada and the other fishing countries (23).

Newfoundland inshore cod landings are made mainly from ICNAF Sub-Areas 2 and 3, as shown in Map 1. Total landings by all countries from these two sub-areas increased from 389,000 metric tons round weight in 1952 to 837,000 metric tons round weight in 1966 (24). The greatest increase occurred in Sub-Area 2 where 338,000 metric tons were taken in 1966 compared with 61,000 metric tons in 1952. Newfoundland's total cod landings (inshore and offshore) from the entire Convention Area declined from 219,000 metric tons to 188,000 metric tons over the same period. The decline in Newfoundland's landings is totally accounted for by the inshore cod fishery (25).

The inshore cod fishery is, therefore, producing less because of increasing landings of cod on offshore grounds. Even

if this were not the case, the inshore fishery could expect declining returns as its own effort increases. Increasing offshore landings cause, and will continue to cause, declining inshore returns, while increasing costs per unit of output can also be expected to continue. The unit catching costs have been increasing due to increasing use of higher valued fishing gear and boats. This increase in capital has not been offset by a decline in labour employed.

The inshore fishing effort is designed to take advantage of the biological behaviour of the cod, but it is also easily hindered by this same behaviour. Over time the amount of cod available to this fishery will be reduced by the offshore effort as well as its own. Therefore, regulation of effort in this fishery is unlikely to have many advantages if the cod fishing effort by all countries in the North-west Atlantic is not controlled.

Before examining the overall fishery policy of past and present governments, we shall look briefly at the economic effects of the present regulations imposed on the inshore cod fishery.

(iv) Economic Effects of Cod Fishery Regulations

Regulations imposed on a fishery usually have some specific purpose such as conservation of the resource, protection of vested interests, safety of those engaged, etc. (26). Of course, the economic objective of fishery regulations is to control effort (and hence fishing cost) so that the differences

between total revenue and total cost for the fishery is maximized. In this light let us look at the economic effects of the regulations governing the Newfoundland inshore cod fisheries.

As evident from our previous summarization of the Newfoundland cod fishery regulations, emphasis is placed on controlling the types of gear used rather than the amount of effort employed. We shall, therefore, comment on the effects of the regulations in order of their importance.

The extensiveness of the cod fishery regulations dealing with cod traps stem from the importance of this gear in the inshore cod fishery. This importance is slowly diminishing with declining total inshore cod landings and landings by cod traps, see page 63. Therefore, some of the effects of these regulations have probably less overall importance now than in the past. As cod trapping continues to decline, the number of local committee controlled areas will probably decrease. The consequence of such a free-for-all situation will probably be less serious in the future when the number of traps will likely continue declining.

The most significant effect of the cod trap regulations, and especially of the local area rules, is their contribution to orderly fishing. The restriction on closeness of traps and other cod gear prevents overcrowding of inshore fishing areas. The rules governing holding of berths in open areas gives the working

fisherman some assurance of having his gear left unmolested by others. Indeed, when he claims a berth subject to the conditions of the Regulations, and fishes it in accordance with them, he has a sort of quasi-property right to that section of the fishing ground for that trapping season.

The regulations which apply to cod trap fishing in local committee areas have two main features: (1) The drawing of cod trap berths gives the residents a preferred quasi-property right to select the best berths, or even all the berths, in that area before outsiders have any chance to fish, (2) The drawing and subsequent licencing of berths eliminates the need to scramble for the best locations when the season starts. In uncontrolled areas crews will often set part or all of a trap very early in the season to retain a prime berth only to have it badly damaged by a storm or ice.

The practice of drawing trap berths adds another element of uncertainity to an already risky business. A cod trap operator may not draw one of the better prime berths. Or he may draw a berth that his trap is unsuitable for fishing because of size or other physical characteristics (27). In the latter case he may be able to exchange his unsuitable berth with another operator if the majority of the committee approves. However, this element of risk must be balanced against that of scrambling for berths in an open area. Indeed, fishermen seem to favour this result of the controlled area regulations (i.e. the orderly fishing aspect) over a free-for-all scramble (28).

Only in unusual cases would the drawing for cod trap berths restrict the fishing effort by this type of gear. In the controlled areas there are usually more than enough locations where traps can be fished. Even if the elegible residents did not draw all the trap berths, any operator from another area is free to fish an unused unlicenced berth. When the fishermen of Port de Grave began building their fleet of longliners, their main fishing grounds were the unused unlicenced cod traps berths in the Cape St. Francis area. The local fishermen were not drawing berths at that time because of employment opportunities at Fort Pepperrell Air Force Base. The Port de Grave men were then free to come and set traps in these berths. When the base at Pepperrell closed, the local men returned to fishing and the prime berths in that area were again drawn for and licenced. This prevented the Port de Grave men from fishing the best berths in that area and they were forced to look elsewhere for good fishing grounds.

The control of cod trapping by local committees might be the basis for restricting this type of fishing effort if such a measure were decided upon in the future. The number of licences for each committee area (29) could be fixed and only that number of traps allowed in any given year. The number of traps fished could be reduced, if desired, by not re-issuing licences for berths which were licenced but not fished in the previous year. Or when a cod-trap operator left the fishery, the number of berths could be reduced the following year by allowing this licence to lapse.

The mesh sizes for cod traps and cod gill nets are intended to allow fish below a certain size to escape these gears. In recent years the cod caught in traps has been of a very small size. As a result, trap crews experience considerable difficulty selling their catches to freezing plants. This small fish when salted produces mainly small-sized low-valued grades. This could be a fairly good case for increasing the size of cod-traps mesh to allow even more of these small fish to escape.

The gill net has been catching the larger cod because of its large mesh size. Some fishermen have claimed these nets are taking breeding fish but the facts are more likely that fish which eluded other inshore gears are being taken by gill-nets. We have already mentioned that landings by gill nets will likely decline when the numbers of fish large enough to be caught in a 5 inch mesh decrease. The mesh size could be reduced to compensate for this but in terms of overall longrun efficiency this might not be justified without some restriction on the total number of nets employed (30).

The restrictions on, or the complete prohibition of, certain types of gear in specified areas are examples of what Scott calls "nautical luddism" (31). Users of one type of gear, usually a traditional type, wish to prevent the use of more efficient types of gear. In the Newfoundland cases, it is the handling crews that object to the other types of gear. In the Harbour Grace Island

area cod traps are legislated against, while in the Fermeuse and Renews areas, line trawls are prohibited during the best fishing period. This type of restrictive measure is now confined to the three areas mentioned. Since they have no real economic advantage, support for such controls is gradually declining.

The various inshore cod fishery regulations contribute little to attaining economic fishing effort. The restrictions placed on total effort are so minor as to be of little value in producing increased economic returns from this fishery. If such a goal is even to be approached in the future, the employment of men and equipment in this fishery must be reduced or, at least, controlled. The effects of offshore effort on the cod stocks available in inshore gears makes some such procedure even more vital.

In terms of Gordon's model, the inshore cod fishery in the long run will experience declining returns and increasing costs. If we take the effect of offshore fishing as an externality to the inshore sector, the stock of cod that becomes available to the inshore fishery can be considered a controllable parameter for it. If offshore effort is controlled, the inshore segment can expect a roughly constant, or even a slightly increasing, amount of cod being available over time. If not, the inshore fishery will have to control its exploitation of a decreasing supply of cod. How these situations may be handled will be dealt with in Chapter VII.

We shall briefly discuss the main government fisheries policies and their effects on the inshore cod fishery before concluding our analysis of this fishery.

(V) The Effects of Government Fishery Policy.

In this section we shall be mainly concerned with the effect of government fishery policy on the amount of effort employed in the inshore cod fishery. In other words, have the assistance policies of government resulted in any improvements in the net economic returns from this fishery?

The content of government financial assistance to the fishing industry has had two distinct phases since 1930. Under Commission of Government the main aim was to stabilize prices to fishermen by instituting orderly marketing procedures for salted cod. Little was done to increase production at the primary level during this period. Since Confederation one of the main aims of government assistance has been to increase the capital base of the primary sector. The chief objective of the bounty plans of the 1950's was to encourage the use of larger and more mobile boats. This probably was based on the need to reduce the number of inshore fishermen. However, the Inshore Fisheries Assistance Programme can only encourage more men to enter the inshore cod fishery.

All the post-Confederation fisheries assistance plans of both federal and Newfoundland governments have tended also to reduce some fishing costs to fishermen. With the absence of

legal restrictions on entry, these plans have contributed to keeping men in the inshore fishery. Little diversification of fishing methods has been achieved. The inshore fishery is still prosecuted mainly by men in open motor boats even though in recent years there has been a substantial increase in the longliner and trawler fleets. Gear subsidies also have tended to increase the number of gill nets and longlines employed but they have not increased total or average inshore cod landings.

Up to the present, therefore, government assistance has worked at cross purposes with the needs of the inshore cod fishery. While men and capital should have been drawn out of this fishery, they have encouraged and enabled to continue in or to enter an uneconomic industry.

We can now briefly restate the economic problems of the Newfoundland inshore cod fishery in terms of the economic and biological theory of fishery exploitation outlined in Chapters 11 and 111.

V1. The problem of Inshore Cod Fishery Restated.

This fishery has been subject to declining physical returns over the last 30 years. Real value returns have also tended to decline in the past years. The value of capital employed has also been increasing steadily indicating higher levels of fishing effort and fishing cost. The landed value per inshore cod fishermen has remained low mainly because too much labour and capital is used on a declining stock of fish. Offshore

fishing effort has contributed to this decline in stocks thus reinforcing the adverse effects of the inshore fishery's own effort.

The inshore fishing gears, despite their immobility, have been able to exert more effort than is needed to take the amount of cod landed. The Walsh Commission stated in 1953 that "If the productivity of the primary fishing industry as a whole were raised to that of the most efficient current operations, i.e. dragging and longlining, the present annual catch of cod fish (approx. 500,000,000 pounds) could be landed by 2,000 men ..." (32). The problem still is one of reducing the amount of labour and capital (and hence cost) in this fishery.

Present regulations do little to restrict total inshore cod fishing effort. The various governmental financial assistance programmes have contributed to an increase rather than a decrease in effort. This may not be completely due to the form of these programmes as one writer has pointed out (33).

If positive net returns from the inshore cod fishery are to be achieved or even approached, effort (cost) must be reduced. This may be a bitter pill when other employment opportunities are relatively scarce. The solution will have to be found in drawing away labour and capital from this fishery in such a manner that the most efficient operators remain. When the number remaining is at a more economic level increases in effort must be prevented or the gains achieved will be wiped out again. The Pacific

Halibut fishery would be a good example of a situation to be avoided. In that fishery, quotas have increased the total catch; but with no other limit on effort the fishery has become overcapitalized (34). A licencing system similiar to that now being enforced in the British Columbia salmon fishery (35) might be a method of reducing and controlling fishing effort in the inshore cod fishery.

We have now concluded our analysis of the inshore cod fishery. An examination of the offshore cod fishery will serve to set the inshore sector in a better perspective. This will be the subject of the next chapter.

Refnotase to Chapter IV

(1) Annual Report of The Newfoundland Fisheries Board, 1945, Department of Natural Resources, St. John's, 1947, p. 23.

(2) Ibid. p. 3.

(3) Annual Report of The Newfoundland Fisheries Board, 1947, Department of Natural Resources, St. John's, 1948, p.7.

(4) For a discussion of the relationship between average and marginal values see: Baumol, W.J., Economic Theory and Operations Analysis, Prentice Hall Inc., Englewood Cliffs, 1961, p.p. 20-35.

(5) This fleet consists of Newfoundland vessels which fish on the Labrador inshore grounds in summer. Their catch is salted on board and sold on the Labrador or taken back to Newfoundland. The catching is done by small motor boats carried on the deck of the floater vessel.

(6) While there is a restriction on Canadian draggers over 65 feet long and all foreign vessels there is no legal barrier to entry by Newfoundlanders using boats under 25 gross tons. There are certain restrictions on the setting of inshore fishing gears but these are not a restriction on entry per se.

(7) The gross returns are taken as indicating the relative level of net returns.

(8) Copes, P., "Government Assistance, Productivity and Income in the Fishing Industry of Newfoundland," a paper presented at the Annual Meeting of the Canadian Political Science Association, Charlottetown, June 1964, p. 4.

(9) Copes, P., Op. cit. p. 5

(10) MacFarlane, D.A., Labour Productivity in the Primary Fishing Industry of the Maritimes and British Columbia, Reference Paper No. 1, Canada Department of Fisheries, Ottawa, 1957, p. 73.

(11) See Edgecombe, R.M. (Miss), "The Newfoundland Inshore Cod Fishery: A Study on Fisheries Management and Labour Allocation", unpublished M.A. Thesis, University of British Columbia, 1967, for a discussion of immobility of inshore cod fishermen.

(12) The cod trap must be fished in an area that can accommodate its box-like shape. Such areas, called berths, must be in 10 to 20 fathoms of water. This, plus the "drawing" of berths in certain areas also makes this gear immobile.

(13) From 1964 to 1966 these gears landed 87.1 per cent of the cod taken by inshore boats and all longliners in the water around Newfoundland and along the Labrador to Cape St. Charles. See Table 8.

(14) Proskie, J., Operations of Modern Fishing Craft, Atlantic Seaboard, 1959, Department of Fisheries of Canada, Ottawa, 1961.
Proskie, J., "Costs and Earnings of Selected Fishing Enterprises, Newfoundland," Preliminary Reports, 1966 and 1967, Department of Fisheries of Canada, Ottawa.

Dunne, E.B., "The Newfoundland Trapboat-Longliner-An Analysis," unpublished BA-B. Comm. Thesis, Memorial University of Newfoundland, 1964.

(15) Information supplied by Department of Fisheries of Canada, Economics Branch, St. John's, Nfld.

(16) MacFarlane, D.A., op. cit., p. 73.

(17) Dunne, E.B. op. cit. p. 34

(18) Landings from cod traps in September are made only in parts of Notre Dame Bay.

(19) Roneyne, Mark, "The Newfoundland Cod Traps", Trade News (now Fisheries of Canada), Department of Fisheries of Canada, Ottawa, Vol. 9, No. 3, 1956, p. 6.

(20) Templeman, W., Marine Resources of Newfoundland, Bulletin No. 154, Fisheries Research Board of Canada, Ottawa, 1966, p. 54.

(21) The mesh size of gill nets could be reduced to compensate for a decrease in average size of fish. This would require a change in the present regulations setting 5 inches as minimum cod net mesh size.

(22) Templeman, W., op. cit., p. 54.

(23) Ibid., p.p. 51 and 54.

(24) ICNAF Statistical Bulletin, Vol. 16, International Commission For the Northwest Atlantic Fisheries, Dartmouth, N.S., 1968, p. 13.

(25) See also: Hodder, V.M., 'Trends in the Cod Fishery off the East Coast of Newfoundland and Labrador", International Commission For the Northwest Atlantic Fisheries Research Bulletin No. 2, ICNAF, Dartmouth, N.S., 1965.

(26) For a fuller discussion of reasons for fishery regulations see: Scott, A, 'The Economics of Regulating Fisheries," in Economic Effects of Fishery Regulation FAO, Rome, 1962, p.p. 28-34.

(27) Report of the Newfoundland Fisheries Development Commission, St. John's, 1953, p. 49.

(28) Ibid., p. 50.

(29) All cod trapping areas then would have to be controlled by local codfishery committees or a similiar body.

(30) See: Scott, Anthony, 'The Economics of Regulating Fisheries", Economic Effects of Fishery Regulation, FAO, Rome 1962, for a discussion on the economics of selective gear regulation (mesh size) p.p. 43-45.

(31) Ibid., pp 30-31.

(32) Report of the Newfoundland Fisheries Development Committee, St. John's, 1953 p. 24.

(33) Edgecombe, R.M. (Miss), op. cit.

(34) Crutchfield, J.A. and Zellner, A, 'Economic Aspects of the Pacific Halibut Fishery", Fishery Industrial Research, Vol. 1, No. 1, United States Department of the Interior, Washington 1963.

(35) See: 'Why Licence Limitation had to be Imposed in B.C.," Canadian Fisherman, St. Anne de Bellevue, Nov., 1968.

VI. The Newfoundland Offshore Cod Fishery

The Newfoundland offshore cod fishery cannot be analysed in the same manner as the inshore cod fishery. This is because of several factors:

(i) Cod fishing is only a small part of the total activity of the offshore fleet.

(ii) Newfoundland vessels exert only a small part of the total offshore cod fishing effort. Any discussion of optimizing this fishery must consider the different income and cost relationships of all the countries involved. As Crutchfield points out, optimization under these conditions is unlikely to be possible, or lead to a number of solutions (1).

We shall, therefore, discuss the Newfoundland offshore cod fishery in isolation from the total cod fishery of the Northwest Atlantic.

A further qualification is also necessary. The offshore cod fishery is defined by the Canada Department of Fisheries as including the activities of all fishing vessels over 25 gross tons (excluding Labrador floater vessels). The offshore fleet, therefore, includes longliners over 25 gross tons and the smaller inshore otter draggers. These vessels are not deep sea craft; their activities could be classified as inshore. In our ensuing discussion of the offshore cod fishery we shall concentrate mainly on the larger otter trawlers and ignore the activities of these smaller craft, because these are really covered by the preceding chapter.

(i) The General Characteristics

Prior to 1945, the deepsea fishery for cod was carried on by the masted banking schooners. This fleet declined in numbers from 1937 to 1945. After that year there was a brief resurgence, but falling salted fish prices and the growth of the otter trawler fleet led to the disappearance of bankers by 1952 (See Table 9).

The banking fleet was concerned solely with catching cod which was salted on board. Baited gear was the catching equipment used. In the period 1937 to 1967, the largest annual offshore landings of cod were made by the banking fleet of 1937 when 104 million pounds were taken.

The first otter trawlers were acquired in 1945. The main part of this fleet, however, was obtained after Confederation, with the greatest acquisition taking place in the 1960's. These vessels are owned by the larger fish freezing companies.

Offshore cod landings have declined in volume since 1937 (See Appendix 1). From 1937 to 1953 the trend in landings was downward as the banking fleet slowly went out of existence. Landings were fairly stable throughout the 1950's and early sixties. An upsurge in offshore cod landings occurred after 1962, was halted briefly in 1967, but resumed again in 1968 (2).

The catch of the banking fleet was directed to the salted fish market. Consequently, as we mentioned above, this fleet disappeared as the price of and demand for salted fish declined. The catch of the deepsea otter trawlers supplies raw material mainly for production of frozen fish products. Since freezing plants

TABLE 9

NUMBER OF OFFSHORE VESSELS, BY TYPE, FISHING COD, BY YEAR, NEWFOUNDLAND, 1937-1967 (1)

Year	Longliners	Danish Seiners	Otter Trawlers	Bankers	Total
1937	-	-	-	137	137
1938	-	-	-	120	120
1939	-	-	-	116	116
1940	-	-	-	100	100
1941	-	-	-	95	95
1942	-	-	-	57	57
1943	-	-	-	64	64
1944	-	-	-	74	74
1945	-	-	2	66	68
1946	-	-	1	82	83
1947	-	-	4	92	96
1948	-	-	9	68	77
1949	-	-	12	53	65
1950	-	-	13	40	53
1951	15	-	16	2	33
1952	28	-	20	4	52
1953	28	-	27	-	55
1954	28	9	31	-	68
1955	28	8	34	-	70
1956	28	8	30	-	66
1957	29	6	28	-	63
1958	29	6	27	-	62
1959	29	8	26	-	63
1960	29	6	29	-	64
1961	29	8	30	-	67
1962	29	5	31	-	65
1963	30	4	42	-	76
1964	31	3	44	-	78
1965	32	-	55	-	87
1966	37	-	53	-	90
1967	44	-	70	-	114

Note: (1) Defined as vessels over 25 gross tons.

Sources: (1) Annual Report of the Newfoundland Fisheries Board and General Review of the Fisheries, 1937 to 1948, Department of Natural Resources, St. John's.

(2) Report on Men, Boats and Gear Employed in Primary Operations 1954, 1956 to 1967, Economics Branch, Canada Department of Fisheries, St. John's, Nfld.

process other species besides cod and can also obtain cod from the inshore fishery, offshore landings of this species have tended to be lower than in the days of the banking fleet.

For the same reasons, cod has formed a relatively small part of the total offshore landings since 1953. Over the last fifteen years landings of cod have averaged 21 per cent of the total catch by offshore vessels, as shown in Table 10. Since cod can also be obtained from inshore fishermen, trawler operators have used their fleets to supply species not available in quantity from the inshore fishery. The two main species processed by freezing plants but not available in sufficient quantity inshore are flounders and redfish.

As the composition of the offshore fleet changed, the number of men engaged declined from a high of 1,839 in 1937 to a low of 341 in 1951, and then rose to 1,229 by 1967 (See Table 11). The offshore fleet became less labour intensive since the disappearance of bankers. However, the otter trawler fleet has an average crew size about the same as the banker fleet had between 1937 and 1952.

Despite the change in the offshore fleet, the cod landings per man declined after the end of the banking fleet, until in 1964 the landings of the previous high year (1947) were surpassed. See Appendix 3. However, since the otter trawlers do not specialize in catching cod, this is not an indication of the total performance of the offshore fleet. It is rather a

TABLE 10

OFFSHORE COD, HADDOCK, FLOUNDERS, AND REDFISH LANDINGS, AS PERCENT OF TOTAL OFFSHORE LANDINGS, NEWFOUNDLAND, BY YEAR, 1953 TO 1967

Year	Cod	Haddock	Flounders	Redfish	Other
1953	15.9	18.9	28.6	36.3	0.3
1954	21.4	47.0	11.5	19.4	0.7
1955	21.3	45.5	16.7	15.7	0.8
1956	12.4	51.1	18.0	17.9	0.5
1957	17.3	43.7	22.4	15.7	0.6
1958	14.4	31.6	26.7	26.5	0.8
1959	21.0	30.3	31.7	15.6	1.4
1960	17.3	24.0	40.2	17.6	0.9
1961	18.6	33.2	27.2	19.9	1.1
1962	16.2	28.6	27.9	25.6	1.6
1963	20.6	8.9	35.9	33.0	1.6
1964	28.4	5.8	40.0	24.5	1.2
1965	26.7	2.5	42.2	27.7	0.9
1966	25.2	1.5	42.7	29.2	1.4
1967	19.6	1.3	51.7	25.6	1.9

Source: Department of Fisheries of Canada, Economics Branch, St. John's, Nfld.

TABLE 11

(1)

NUMBER OF OFFSHORE COD FISHERMEN ON GIVEN TYPES OF VESSELS, BY YEAR, NEWFOUNDLAND, 1937-1967

Year	Longliners	Danish Seiners	Otter Trawlers	Bankers	Total
1937	-	-	-	1,839	1,839
1938	-	-	-	1,601	1,601
1939	-	-	-	1,624	1,624
1940	-	-	-	1,419	1,419
1941	-	-	-	1,426	1,426
1942	-	-	-	717	717
1943	-	-	-	866	866
1944	-	-	-	1,001	1,001
1945	-	-	26	838	864
1946	-	-	12	1,095	1,107
1947	-	-	69	1,330	1,399
1948	-	-	116	1,110	1,226
1949	-	-	174	1,100	1,274
1950	-	-	184	500	684
1951	60	-	241	40	341
1952	112	-	301	60	473
1953	112	-	408	-	520
1954	96	42	428	-	566
1955	96	42	434	-	572
1956	112	40	378	-	530
1957	116	24	414	-	554
1958	116	26	379	-	521
1959	116	42	369	-	527
1960	116	36	414	-	566
1961	116	49	438	-	603
1962	116	20	455	-	591
1963	120	20	558	-	698
1964	124	12	648	-	784
1965	128	-	805	-	933
1966	148	-	807	-	955
1967	174	-	1,055	-	1,229

Note: (1) Defined as men on vessels over 25 gross tons.

Sources: (1) Annual Report of the Newfoundland Fisheries Board and General Review of the Fisheries, 1937 to 1948, Department of Natural Resources, St. John's.

(2) Report on Men, Boats and Gear Employed in Primary Operations 1954, 1956 to 1967, Economics Branch, Canada Department of Fisheries, St. John's.

measure of the amount of effort this fleet has exerted on cod-fishing. Each year since 1953 the offshore fleet has sought other species more than cod. From 1954 to 1958, and 1961 to 1962, haddock was the main species sought (3). Similarly, flounders were the main species in 1959-60, and 1963 to 1967. Redfish, was mainly sought in 1953 only, but between 1956 and 1967 it was sought more than cod.

The total value of offshore cod landings has increased steadily since 1938. See Appendix 1. While the bankers were eliminated because of falling salted fish prices, the offshore fleet has enjoyed rising average prices over the last 31 years. See Appendix 4. Before 1966 the favourable incomes of the offshore fleet can be attributed to good market prices for fresh frozen products. However, in the last two years, when the latter market prices began to decline, the problem of keeping crews on trawlers was one factor in the policy of sustaining prices for landed fish. As a result of rising landed value and the overall decline in the number of offshore cod fishermen, the average landed value has increased several times since 1937.

From 1964 to 1967, there was a large increase in the amount of capital invested in the offshore fleet. See Appendix 5. Almost all of this increase has been in larger, more powerful stern otter trawlers. In these years there was also a substantial increase in the amount of capital available to each offshore fisherman. Even though the offshore fleet seeks other species more than cod, this increased capitalization has increased output in the offshore cod fishery.

The offshore cod fishery has, therefore, begun to recover in terms of landings and employment of men over the last few years. However, since this offshore fleet is mainly a supplier of raw material for freezing, the continuation of these trends will depend on this demand for cod as a raw material and the amount supplied by the inshore fishery. We have already discussed the possibility of the inshore fishery's supplying less cod in the future. If cod landings should be required on the same level as the last few years, then the offshore otter trawlers will have to produce greater catches of this species. Studies conducted by the Department of Fisheries of Canada in 1966 and 1967 showed these vessels experience some economic difficulties (4). We shall now examine the problems which must be solved if trawlers are to economically fulfill the expected requirements of cod landings.

(ii) Some Problems of the Otter Trawler Fleet.

The present fleet of otter trawlers are owned and operated by several of the fish freezing companies. They are intended primarily to supply species which cannot be obtained inshore or be supplied by that source for only limited periods. These fleets are part of the vertical integration of some processing firms. Any losses from trawler operations must be absorbed by the processing activity. The otter trawler fleets should be operated only when the processing losses that might be incurred if they were not employed, are greater than the trawler losses. However, to achieve economic efficiency, both operations should operate at the point where the marginal cost and the marginal revenue of each are equal.

The extent of the problems encountered by the otter trawler fleet is reflected in Table 12. Both the 120 foot and 130 foot side-trawlers operated at losses in 1966 and 1967. The Stern-trawlers also operated at a loss in 1967, the first year for which data are available on their operations. The average age of the side-trawlers studied in 1966 was three years while in 1967 the average age was four years. The average age of the stern-trawlers covered in the 1967 Costs and Earnings Study was one year. It is very likely that the average performance of the entire side-trawler fleet is even poorer than indicated in Table 12. The older vessels of this fleet will have more lost fishing time because of mechanical breakdowns, shortage of crew members, etc. On the other hand, the stern-trawler fleet may operate a little better than indicated by the 1967 Study as the first year of operation is usually hindered by breaking-in problems.

It is physically impossible for both size classes of side-trawlers to break even with the cost and revenue parameters operating in 1966 and 1967. Based on the average performance of these two years the 120 foot side-trawler would need an increase of 10,371,250 pounds of landings annually to eliminate the boat loss shown in Table 12. The actual annual landings (1966-67) average of this size class of trawler are 5,676,379 pounds. Therefore, if average revenue and average variable costs remain the same, an increase of 183.7 per cent in output must be achieved for this class of trawler to cover Variable and Fixed Costs excluding a return to capital employed.

TABLE 12

SUMMARY OF AVERAGE FINANCIAL OUTCOMES FOR SELECTED SIDE TRAWLERS, 1966, and 1967, AND FOR STERN TRAWLERS, 1967, NEWFOUNDLAND

	1966 Side Trawlers		1967 Side Trawlers		Stern Trawlers
	120 ft.	130 ft.	120 ft.	130 ft.	
	($)	($)	($)	($)	($)
Total Receipts	151,375	189,221	141,226	137,158	174,188
Cash Expenditures					
Maintenance & Repairs	32,670	36,283	30,234	43,543	51,499
Other Operating Expenses	35,044	51,958	32,598	40,011	39,338
Fixed Charges	30,615	13,890	32,612	18,168	29,997
Total	98,329	102,131	95,444	101,722	120,834
Net Returns to Labour and Capital	53,046	87,090	45,782	35,436	53,354
Less:					
Payments to Crew	62,808	78,070	61,574	65,932	86,492
Boat Share	-9,762	9,020	-15,792	-30,496	-33,138
Less: Depreciation	20,412	20,538	20,411	22,217	33,322
Net Earnings of Boat	-30,174	-11,518	-36,203	-52,713	-66,460

Note: (1) In 1966 three 120 foot and six 130 foot side trawlers were covered; in 1967 three 120 foot and five 130 foot side trawlers and three 148 foot stern trawlers were included.

Source: Proskie, J., Costs and Earnings of Selected Fishing Enterprises, Newfoundland, Canada Department of Fisheries, Ottawa, Preliminary Report, 1966 and 1967, Table 5 (Appendix)

CHART 8

PROJECTED BREAKEVEN CHART FOR NEWFOUNDLAND 120 FOOT SIDE TRAWLERS

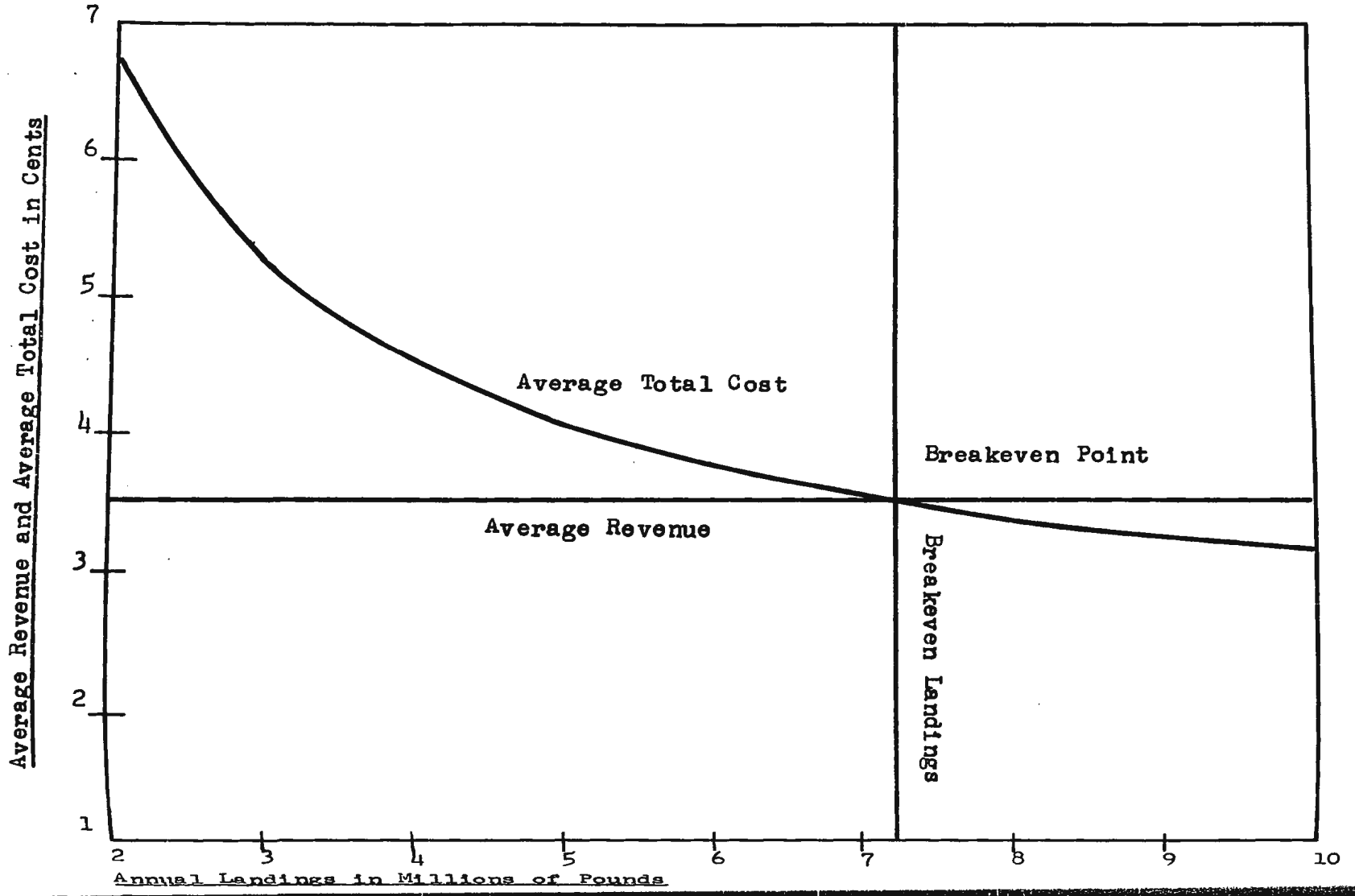


Table 13 contains a breakeven calculation for 120 foot side-trawlers which is also shown in Chart 8. Average revenue (price per pound of landings) was fixed at 3.5 cents compared with the actual revenue of 2.58 cents. Average variable cost was set at 2.25 cents per pound compared with the actual 2.26 cents. The fixed charges and depreciation allowances were taken as the actual amounts (5). A return to capital of 7 per cent was added. With these revenue and cost parameters this class of trawler must land 7,272,000 pounds of fish annually to break even. This represents a 28 per cent increase over actual performance.

The crucial factors in this projected performance are: increased landings, increased average revenue and decreased average variable cost. If all, or any of these goals cannot be achieved, this type of vessel will not be economical to operate. We shall now look more closely at each of these factors and determine whether the necessary changes are possible.

The amount of fish landed annually depends upon: the number of trips made, the number of days at sea, the number of days fished, as well as the number of hours fished and the rate of catch per trip, day at sea, day fished and hour fished. A poor performance in any of these areas will mean lower annual catches.

To be used effectively, an otter trawler should at least reach the "80 per cent availability level"(6) in days at sea, days fished and hours fished. In Table 14 the actual utilization in these areas is compared with the 80 per cent bench mark.

TABLE 13

COMPARISON OF ACTUAL FINANCIAL PERFORMANCE

WITH A PROJECTED BREAKEVEN PERFORMANCE

FOR NFLD. 120 FOOT SIDE TRAWLERS

	Actual (1)	Breakeven
Annual Landings (lbs.)	5,676,379	7,272,000
Average Revenue (¢)	2,58	3.50
Total Revenue ($)	146,300	254,520
Average Variable Cost (¢)	2.26	2.25
Total Variable Cost ($) (2)	127,464	163,620
Fixed Expenses & Depreciation ($) (3)	52,024	52,000
Return to Capital ($)	-33,188	38,900 (4)

Notes: (1) Based on 1966 and 1967 data contained in Costs and Earnings of Selected Fishing Enterprises, Newfoundland.

(2) Variable cost is taken as Maintenance and Repair and Other Operating Expenditures plus payments to crew. See Table 12.

(3) Taken as given in Table 12.

(4) Taken as 7 per cent of total capital invested, includes subsidy payments.

Source: As per Table 12.

The 120 foot side-trawler is below par in all these utilization areas. However, if these rates of use can be attained, the breakeven catch is within reach. As Table 14 shows, the breakeven rate of catch for most of these operating parameters does not significantly vary from the actual. However, if the vessel can fish for 80 per cent of the available fishing hours, the catch per hour can be reduced by 30 per cent. As there seems to be no immediate danger of reduced catch per unit of effort for these vessels, achieving greater utilization is, therefore, the main concern in the short run.

The number of days at sea should depend mainly upon the vessel's being in working order and sufficient crew members available. These vessels are fairly seaworthy, and only major storms should keep them in port. Annual refit and the Christmas lay-over should take 28 days. Turn-around time between trips should be 29 days a year. The bench mark (290 days at sea), therefore, leaves 18 days for unexpected mechanical troubles. This should be ample for any well maintained craft.

Therefore, the major factor in attaining 290 days at sea will be the availability of crew members. The Costs and Earnings Study indicates this may cause considerable lost fishing time as well as poor performance in other areas (See Page 96). In 1966 the turnover of crew members on 120 foot side trawlers was as follows:

Trawler	Normal Crew No.	Range in Men per Trip	Total Men Employed
1	14	11-14	20
2	14	11-13	38
3	14	10-14	26

The average ratio of total men employed to normal crew was 2.4:1. The most frequent causes of turnover were men quitting the vessels or absenteeism. The turnover of crew members is also reflected in the number of trips made with different sizes of crew by these vessels in 1966 and 1967: (7)

Size of Crew	Number of Trips	
	1966	1967
11	4	3
12	35	24
13	35	47
14	6	4
15	-	-

Only 7.6 per cent of the trips were made with a full crew of 14 men in 1966. In 1967 this class of trawler has a full crew only 6.3 per cent of the time. The remainder of the time these trawlers were understaffed and hence could not be operating in an efficient manner. This problem of crewing side trawlers must be solved if these vessels are to be fishing effectively for the maximum periods of time.

The number of days fished depends upon the number of days required to sail to and from the fishing grounds; the total number of days at sea and time lost due to stormy weather encountered at sea.

TABLE 14

COMPARISON OF ACTUAL AND A PROJECTED BREAKEVEN OPERATING EFFICIENCY OF NEWFOUNDLAND 120 FOOT SIDE TRAWLERS

	Actual (1)	Breakeven
Annual Landings (lbs.)	5,676,379	7,272,000
Number of Trips	26.5	29
Landings per Trip (lbs.)	214,203	250,758
Number of Days at Sea (2)	237.5	290 (5)
Catch per Day at Sea (lbs.)	23,901	25,076
Number of Days Fished (3)	193	232
Catch per Day Fished (lbs.)	29,411	31,345
Number of Hours Fished (4)	2,442	4,454
Catch per Hour Fished (lbs.)	2,324	1,633
Days at Sea per Trip	8.96	10
Hours Fished per Day at Sea	10.28	15
Hours Fished per Day Fished	12.65	19

Notes: (1) Based on 1966 and 1967 data contained in "Costs and Earnings of Selected Fishing Enterprises, Newfoundland."

(2) From date sailed to date landed.

(3) Days in which catching operations take place. Could be different from days on grounds if vessel must heave to because of stormy weather.

(4) Hours in which catching operation take place.

(5) Calculated at "80 per cent availability level".

Another factor will be the working condition of the ship's engines, equipment and fishing gear. Due to the proximity of the fishing grounds, sailing to and from port should not take more than two days per trip for Newfoundland 120 foot trawlers. Because of these vessels' seaworthiness, stormy weather should not frequently prevent fishing, while good maintenance procedures should eliminate lost fishing time at sea. Efficiently maintained and operated vessels should have no major difficulty fishing 80 per cent of the days they are at sea.

In terms of actual catching the number of hours fished will be crucial. If a vessel fished 232 days a year, 5,568 hours are available for actual fishing activities, i.e. shooting and hauling its otter trawl. To achieve "80 per cent availability level" 4,454 hours must be fished annually or 19 hours for each day of fishing.

To achieve these 19 hours of fishing per day the trawler must be fully crewed by competent seamen. The trawl must be shot and hauled back in the shortest period of time (8). Each man engaged in this operation must be thoroughly familiar with his duties. Because the amount of time required to store and ice the catch also affects the fishing time of the trawl, the need of qualified icers and fish-hold hands is also vital. Time lost repairing damaged fishing gear can be kept to a minimum by carrying spare trawls and crew members qualified in trawl repairs.

Attaining 19 hours fishing per day will also be affected by the captain's ability to locate quantities of fish warranting shooting the trawl. This requires a good knowledge of fishing locations and ability to effectively operate the available electronic fish finding equipment.

The major difficulty in reaching these operating levels is, therefore, the availability and skill of crew members. If this difficulty can be overcome, and the utilization rates achieved, there will be no problem in landing the breakeven catch of 7,272,000 pounds. These utilization rates can be achieved on an annual basis: a poor performance on one trip can be offset by a better than average performance on other trips.

Having established that the breakeven catch is possible, we shall now examine the requirements of achieving the needed average revenue. This depends on the amount of higher valued species landed and the amount of fish rejected and, therefore, usually not paid for. The landed price for any species will be determined mainly by its quality when landed, the cost of producing a finished product, and the market price for that product. Differences in prices for a single species will also be determined by the form in which the fish is landed; gutted fish is usually priced higher than round fish of the same species. The species, which were priced higher than the breakeven average revenue and landed by 120 foot trawlers in 1966 and 1967, are shown in Table 15.

TABLE 15

SPECIES LANDED IN 1966 AND 1967 BY NEWFOUNDLAND

120 FOOT SIDE TRAWLERS WITH AVERAGE PRICE

HIGHER THAN PROJECTED BREAKEVEN AVERAGE REVENUE

Species, Size and Condition	Price per Pound (¢)	
	1966	1967
Cod, unsized, gutted head on	4.23	4.00
Haddock, unsized, gutted head on	4.00	4.69
Haddock, large, gutted head on	4.00	4.99
Haddock, jumbo, gutted head on	5.00	-
Haddock, small, gutted head on	-	-
Halibut, unsized, gutted head on	15.00	15.00
Halibut, unsized, gutted head off	15.30	15.00
Halibut, large, gutted head off	15.20	-
Redfish, large, round	4.29	-
Flounders, unsized, round	-	3.49

Source: As per Table 12.

The weighted average value of the listed species in 1966 was 3.56 cents per pound and 4.35 cents in 1967.

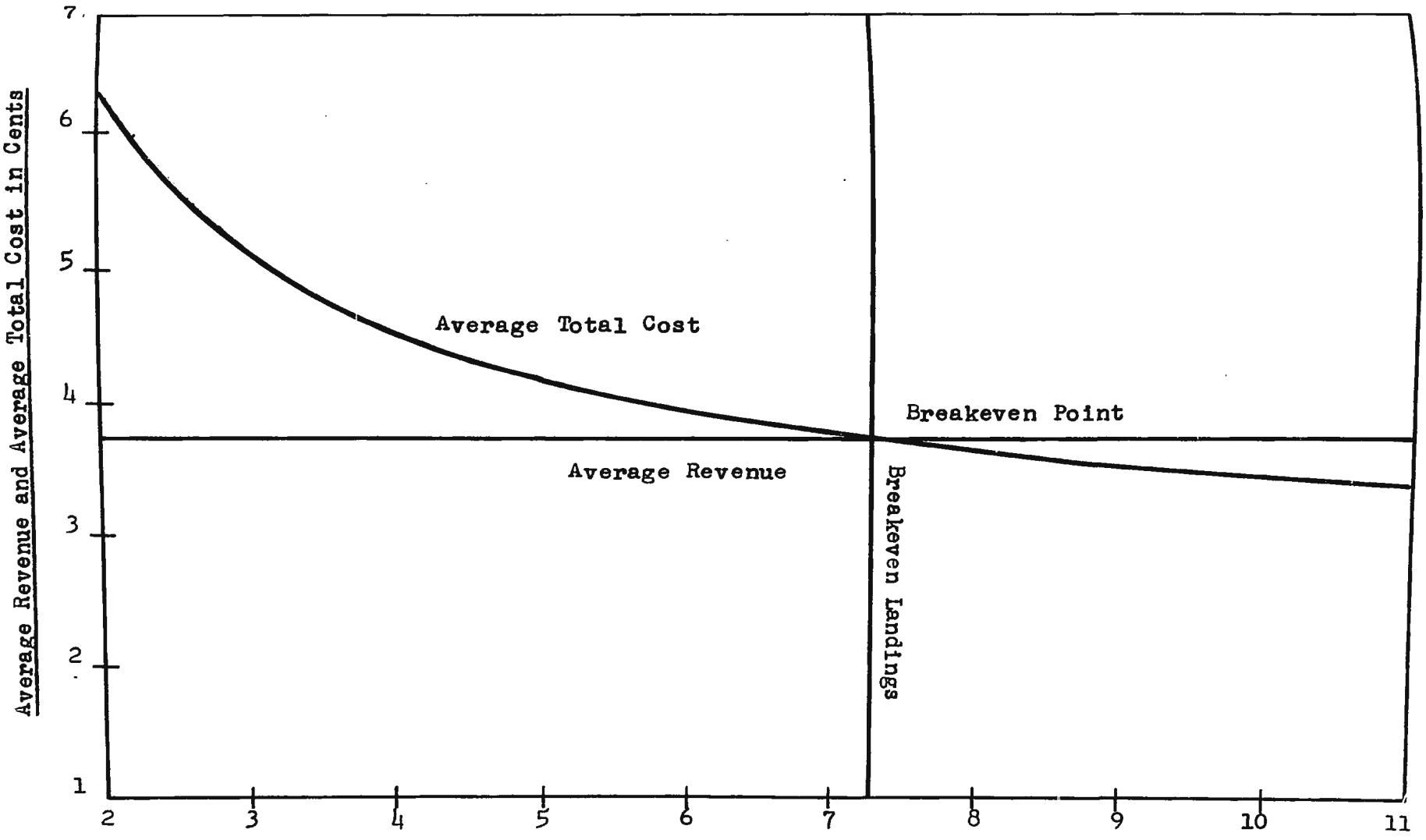
It is possible, therefore, to achieve the needed average revenue by concentrating mainly on the higher valued species. This does not mean lower priced species need not be landed; the quantity of such fish must be reduced so that an average revenue of 3.5 cent per pound of landings can be attained.

The quality of landed fish could reduce the average revenue if excessive amounts are rejected as unfit for frozen production. Such rejected fish is usually not paid for or a very small price is paid. Thus, in 1966, 0.08 cents per pound was received by 120 foot trawlers for rejected fish (9). Fish rejected from these vessels equaled 12.7 per cent of their total landings in 1966 and 10.8 per cent in 1967. The value of these rejected landings was only 0.004 per cent of the total value in 1966 and only 0.0009 per cent in 1967. Average revenue was reduced as much as 10 per cent because of these rejected landings. While this would not wholly account for losses incurred, it means no revenue is produced for about 10 per cent of fishing time.

Because most buyers make standard deductions from gross weights to cover ice and/or entrails, "rejected" landings cannot be completely eliminated. They can, however, be reduced close to the normal deduction by practicing proper icing and keeping the length of a fishing trip at an average duration of ten days. Since this is the length of trip we have set for our breakdown performance, improvement in quality of landings must come from better icing. This will require skilled icers and fish-hold hands. A bonus wage for quality of catch has been introduced with some success by certain trawler operating companies.

The final obstacle to attaining the breakeven performance is reducing the variable cost per pound of landings. Some reductions in variable costs are likely to result if the quality of crew members

PROJECTED BREAKEVEN CHART FOR NEWFOUNDLAND 130 FOOT SIDE TRAWLERS



Source: Appendix 19

is improved. Other reductions could be achieved by a general upgrading of trawler operations and maintenance procedures.

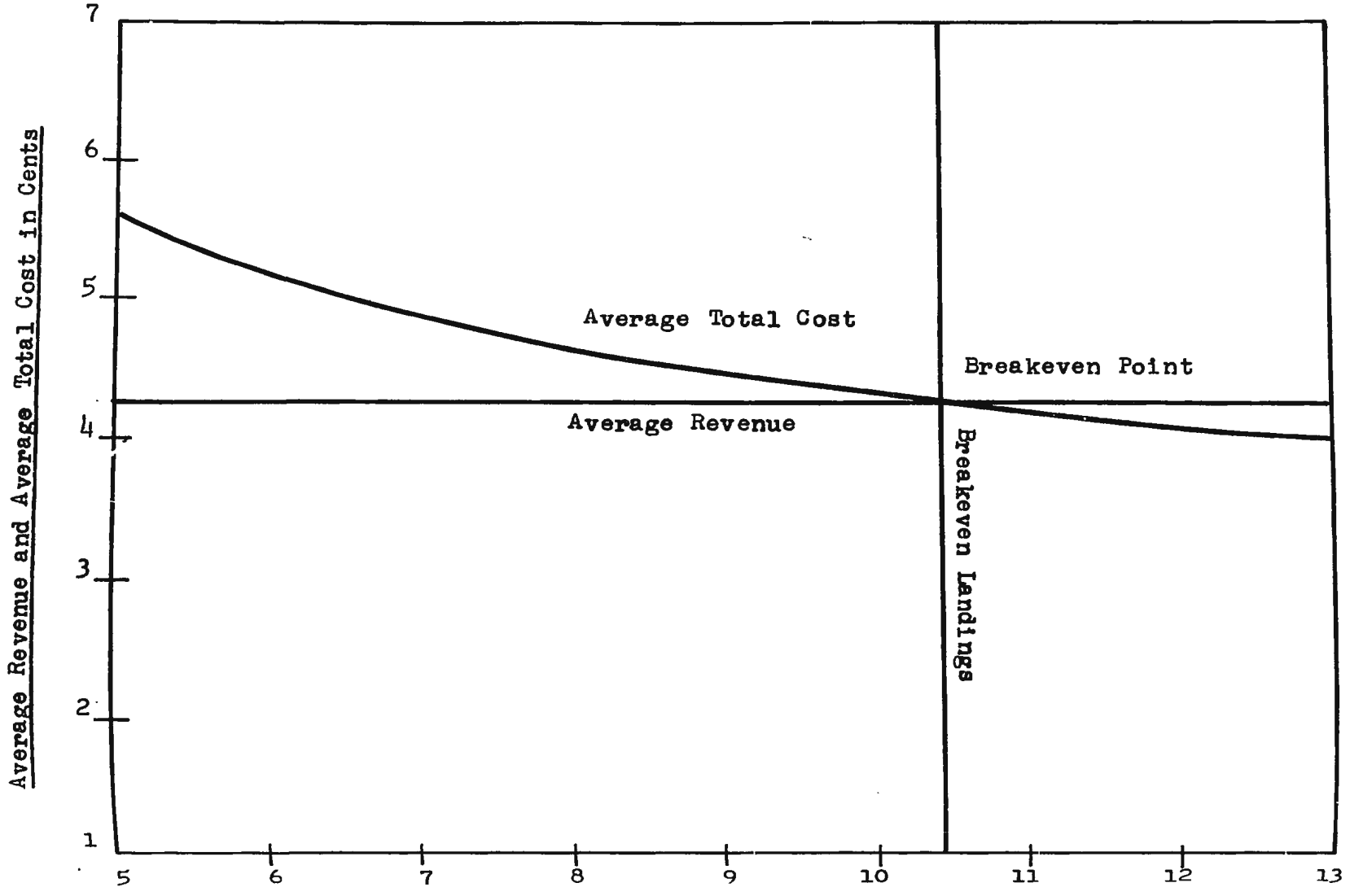
The specific areas where most of the reduction in average variable costs can be achieved are: maintenance and repairs of hull, engine and catching gear, and purchase of fuel, oil and grease. While most of these expenses will increase in total with the projected breakeven performance, reduction in average variable costs can be achieved by keeping the rate of increase in these expenses less than the rate of increase in landings.

While we have shown that the breakeven point for 120 foot side-trawlers can be reached by increasing the annual catch and average revenue and decreasing average variable cost, the parameters we have set are only targets. The breakeven point could be reached with different values of average revenue and variable cost. A higher average revenue than given in our projection would mean average variable cost need not be reduced to 2.25 cents per pound. Or, if average variable cost is reduced below 2.25 cents, average revenue could be less than 3.5 cents. In any case landings must be increased over the present level if these vessels are to cover total costs and provide a return to capital.

Similiar arguments can be applied to the 130 foot side-trawlers and the 148 foot stern-trawlers. Both operate at substantial losses, which can be eliminated only by increasing total landings and average revenue and by decreasing average variable cost. We have performed breakeven projections for these classes of vessels as

CHART 10

PROJECTED BREAKEVEN CHART FOR NEWFOUNDLAND 148 FOOT STERN TRAWLERS



shown in Appendices 19 and 22 and Charts 9 and 10. The actual performance are also shown in these appendices. The actual operating rates of utilization are compared with the projected breakeven performance in Appendices 20 and 23. All the comments on needed changes in the operation of 120 foot side-trawlers can also be applied to the 130 and 148 foot vessels.

Before concluding this discussion of the otter trawler fleet, we should point out a fallacy in judging the operation of this fleet by the average cost of landed fish. If the average cost of fish landed by a company's otter trawler fleet is greater than the average price that would be paid others for the fish, it is uneconomic to operate the fleet. In other words, if the price paid for fish caught by its own trawlers is equal to the market price, then these vessels must produce sufficient landings to cover all costs including an adequate return to capital. If not, it is better for that company to buy its fish supplies elsewhere. The operations of its trawlers are, in effect, reducing the company's overall profit.

Now that we have examined the internal problems of the deepsea fleet, we shall briefly discuss its position in the Northwest Atlantic cod fishery. The efficiency of the fleet relative to that of other fleets operating in the Northwest Atlantic is the key to the future of the Newfoundland cod fishery.

(iii) Competition for the Resource

The Newfoundland offshore fleet competes with the fleets

of other countries for cod catches in the Northwest Atlantic. This is more true of the deepsea otter trawlers than it is of the larger longliners and small draggers. The relative position of the Newfoundland offshore cod fleet depends on how well it can outfish the others.

While the Newfoundland deepsea vessels take only a very small percentage of the total cod catch in the ICNAF Convention Area, they have increased this share since 1952. While the Newfoundland offshore fleet took only 2.4 per cent of the total cod catch in 1966, it had increased its landings to 318 per cent of its 1952 catch (See Table 16). The total catch from the Convention Area increased 45 per cent over the same period. This means, therefore, Newfoundland offshore vessels can compete for the cod of the Northwest Atlantic. The position is even more favourable, when one considers that Newfoundland trawlers had not prosecuted the cod fishery off Labrador to any extent by 1966, and that cod fishing is only a small part of their total fishing activity. Therefore, increased cod landings by this fleet canbbe expected.

However, a word of caution must be added to this optimistic outlook. As the cod catch continues to increase, the possibility of biological overfishing must be remembered. This situation is now being closely studied by the International Commission for the Northwest Atlantic Fisheries. If biological overfishing exists or is being approached, we are already in a situation of economic overfishing. In such a case, any increase

TABLE 16

COD LANDINGS FROM THE ICNAF CONVENTION AREA

BY ALL COUNTRIES, BY ALL NEWFOUNDLAND VESSELS,

AND BY NEWFOUNDLAND OFFSHORE VESSELS,

1952 TO 1966

(quantities in metric tons round weight)

Year	Total All Countries	Nfld. Total	Newfoundland Offshore	
			Quantity	Per Cent of Total All Countries
1952	1,017	219	11	1.1
1953	906	189	7	0.8
1954	969	246	12	1.2
1955	902	207	13	1.4
1956	967	220	8	0.8
1957	958	222	10	1.0
1958	884	165	8	0.9
1959	954	232	11	1.2
1960	1,134	228	10	0.9
1961	1,304	183	12	0.9
1962	1,340	206	12	0.9
1963	1,336	222	16	1.2
1964	1,402	204	26	1.9
1965	1,463	190	33	2.3
1966	1,477	188	35	2.4

Source: ICNAF Statistical Bulletin Vol. 16, International Commission for Northwest Atlantic Fisheries, Dartmouth, 1968.

in the cod catch by Newfoundland offshore vessels must be made at the expense of others. And if the Northwest Atlantic cod fishery slips into biological overfishing catch per unit of effort will fall more rapidly for the fishery as a whole. An increase in, or maintenance of, Newfoundland's offshore catch of cod would then be increasingly difficult and costly. Unless tastes change, this would be a most uneconomic situation for the Convention members as a whole.

Now that we have examined the offshore cod fishery we are in a better position to compare it with the inshore fishery. This shall be the purpose of the next chapter.

NOTES TO CHAPTER VI

(1) See Crutchfield, J.A., "The Marine Fisheries; A problem in International Co-operation", American Economic Review, Vol. 54, No. 3, p.p. 207-218.

(2) Information supplied by the Economics Branch, Canada Department of Fisheries, St. John's, Nfld.

(3) For all practical purposes, the main species landed in a year is the main species sought. This might not be true for shorter periods such as a 10-12 day fishing trip.

(4) Proskie, J., Costs and Earnings of Selected Fishing Enterprises, Newfoundland, 1966 & 1967- Canada Department of Fisheries, Ottawa. Hereafter called the "Costs and Earnings Study".

(5) Ibid., Table 1 of Appendix.

(6) This means the trawler is employed for 80 per cent of the time available. For example, she should be at sea 290 days (80 per cent of 365), fish 232 days (80 per cent of 290) and fish 4,454 hours (80 per cent of 232 x 24).

(7) Proskie, J. op. cit., Table 11.

(8) Time spent shooting and hauling the trawl will also be effected by the deck layout of the vessel. While no information is available on this item, we assume deck layout is adequate to ensure efficient operation of the trawl.

(9) Proskie, J., op. cit., Table 2.

VII. A Comparison of the Inshore Cod Fishery and the Offshore Cod Fishery

(i) General Comparison

In almost every area the comparisons of the inshore and offshore cod fisheries are striking. The inshore fishery employs 94.8 per cent of the total cod fishermen and lands 85.9 per cent of the total cod catch whereas the offshore fishing employs 5.2 per cent of the men but catches 14.1 per cent of the landings (1). The trend in the inshore cod landings has been downward since 1937 whereas the offshore fishery, after a decline when bankers disappeared, has increased its landings steadily over the last five years. The trend in the number of inshore cod fishermen has been downward while the offshore fishery has led to an increase in the amount of labour employed. The catch per inshore cod fisherman has not improved on the average over the last 30 years. The average offshore cod catch tended downwards from 1937 to 1953 but has moved upward considerably since then. Since 1963 the average offshore cod catch has averaged 303 per cent of the catch per inshore fishermen; the landed value per offshore fisherman has been 170 per cent greater than that of the inshore average over the same period.

From 1954 to 1965 the value of all capital employed in the inshore cod fishery was greater than that used in the offshore sector. In 1966 the offshore fishery employed 54 per cent of the capital used in cod fishing and increased this to 68 per cent in 1967. The amount of capital per inshore cod fisherman, while increasing since 1954, has never been more than 6 per cent of the amount used by his offshore

counterpart. Since 1954 the inshore cod fisherman has used only 4.8 per cent of the capital employed by each offshore cod fishermen. This difference is reflected in the average landed volumes and values per inshore and offshore fisherman despite the fact that offshore capital is used only about 20 per cent of the time for cod fishing.

The inshore cod fishery is, therefore, labour intensive, while the offshore fishery is much more capital intensive. The inshore segment of the cod fisheries has a considerable degree of underemployment of labour - the same catch could be taken with fewer men. The offshore fishery suffers from very low or negative returns to the capital employed in its most element, the otter trawler fleet. The problem facing both fisheries are evident: labour must be reduced in the inshore sector and capital must be more efficiently used in the offshore fishery.

(ii) The Outlook

Under existing conditions the outlook is not bright for either the inshore or the offshore cod fishery. Let us pursue what will happen if past conditions are allowed to continue.

With no change in outside influences, government policies, or the technology used, the inshore fishery will continue to be characterized by too many men catching too few fish. The number of men engaged will be reduced only as the older people retire and their places are not taken by younger men. This process is likely to be long term and any significant reduction will depend on alternative employment opportunities becoming available to the younger age groups. The continuation of existing subsidies on boats

and gear will encourage men to remain in this fishery and entice others to enter. The existing cod fishery regulations have no significant effect on reducing effort in the inshore fishery. Under present conditions only expansion of alternative employment will reduce the number of inshore cod fishermen.

With effort unlikely to decrease significantly the problem of the inshore fishery is aggravated by the effect of offshore fishing on the cod stocks migrating inshore. If this offshore activity continues as in the past, the Newfoundland inshore cod fishery will be based on a gradually declining supply of cod. This will result in lower average annual landings and increased fishing costs. The value of these landings is also likely to decline as the fish will become smaller and smaller in size. This will reduce its commercial value for both frozen and salted production. This is already being experienced in the cod trap fishery.

The present inshore fishing gears are not mobile enough to offset the effect of reduced supplies of cod. Not only will fewer cod be available for catching with this equipment, but the fish are likely to be better fed as natural food will be relatively more plentiful. They could then become glutted and sluggish shortly after arriving inshore; consequently they may stay near the bottom and not move enough to be caught by traps or gill nets. The smaller size of the cod will also be a hinderance to sustaining catches by fixed mesh size gill nets. Both factors will also cause reduced catches by baited gears. When

this situation develops, gears with an element of pursuit, such as bottom or mid-water otter trawls will be even more successful than the inshore gears.

If cod continues to be demanded at the level of the last several years, the decrease in inshore landings must be made up by offshore catches. Landings of cod by deepsea trawlers can be increased by fishing "the great winter and spring concentrations of cod in deep water in Cabot Strait, the Halibut Channel, and the Avalon Channel, and on the northern slope of the Grand Bank, Flemish Cap, the Northeast Newfoundland Shelf, the eastern Slope of Hamilton Inlet Bank, and elsewhere. For summer and autumn fishing the trawlers will need to follow the European pattern of fishing in the northern part of (ICNAF) Subarea 3, the southern part of Subarea 2, and for larger freezer-trawlers, the West Greenland Area" (2).

Increasing the offshore cod catch in this manner will be one way of improving the economic performance of the otter trawler fleet. With the cutback in the government subsidy on steel fishing vessels, there is unlikely to be any significant increase in this fleet for a few years. However, substantial increases in cod landings can be achieved by operating existing vessels more extensively and efficiently. The long run result will be an increase in the otter trawler fleet and increased employment of labour.

As the Newfoundland trawlers begin to increase their

their fishing activity for cod, they will increase the total effort on this species in the Northwest Atlantic if the Newfoundland inshore effort is not reduced. This will eventually lead to declining returns from the Northwest Atlantic cod fishery and increased costs of fishing. The danger of economic, if not biological, overfishing of this fishery must be a concern of all the cod fishing countries. From the point of view of this Province, alone, if the Newfoundland total catch of cod is maintained in the future at present levels, the onus will be on other countries to avoid causing overfishing if they should significantly increase their catches. Templeman does not appear concerned with biological overfishing of cod, "which of all the groundfishes in the Northwest Atlantic ..... are best to stand an intensive fishery" (3). However, economic overfishing occurs before the maximum yield is achieved and this danger may be already approaching (4).

Now that we have compared the inshore and offshore cod fisheries and looked at the future possibilities, we are ready to summarize our findings, make our conclusions and recommend a plan of action of these fisheries. This we will do in the final chapter.

NOTES TO CHAPTER V11

(1) These percentages are based on the years 1963 to 1967.

(2) Templeman, W., Marine Resources of Newfoundland, Fisheries Research Board of Canada, Ottawa, 1966, pp 54-55.

(3) Ibid., p. 53.

(4) This possibility is being investigated by the International Commission for the Northwest Atlantic Fisheries which established in 1966 a Working Group to ".... carry out an examination of the problems of assessing the economic effects of possible conservation measures...." The report of the Group was presented to the Commission's 17th Annual Meeting in 1967.

Ch. VIII Summary, Conclusions and Recommendations

(i) Summary and Conclusions

We shall first summarize our findings in the inshore cod fishery. Following a similiar summary of the offshore cod fishery we shall present our conclusions on each fishery.

Over the last 31 years the inshore cod fishery has experienced a decline in total catch and numbers of men engaged. The average catch, while showing some fluctuations, has not tended to rise or fall over this time. As a result of increasing landed prices the total landed value and the landed value per man have exhibited upward trends. However, in the last two or three years general price increases have reduced the real value of the catch.

The volume of the catch has continued to decline despite substantial increases in capital employed in this fishery. This capital has been subsidized by government and this policy has caused men to remain in this fishery even though less and less fish is being caught. The fact that the numbers of fishermen decline in periods of rising employment illustrates the desire to move out of this fishery whenever possible.

We have discussed the various factors prohibiting movement of labour from this fishery. The various government assistance schemes have worked in the opposite direction. The regulations imposed on the inshore cod fishery have no significant effect on reducing the total effort exerted. Only physical or economic factors prevent men from engaging in the codfishery in some manner or other.

We have seen that the immobile inshore fishing gears are subject to the behaviourial characteristic of the cod. They lack the element of pursuit and can be successful only when the cod come within their range. However, at the same time, we have argued that these immobile gears have exerted more than enough fishing effort because of their numbers and the decreasing amount of cod available in inshore waters. Because the cod caught inshore migrates from offshore grounds, the fishing activity on these latter grounds affects returns from the inshore cod fishery.

The offshore cod fishery has become a very capitalized industry characterized by increasing employment of labour, increasing total and average catch. However, codfishing is only a part-time activity for the men and equipment employed in the total offshore fleet.

The nucleus of the present offshore cod fishing fleet are the otter trawlers. These vessels have replaced the banking schooners as the sea-going craft of this industry. However, these same vessels are also presenting the major problem of the offshore cod fishery. While not subject to the vagaries of the cod resource as inshore vessels are, the offshore otter trawler fleet has not been operating profitably. While these vessels have not been catching cod to any great extent in the past, we have forecasted they will be required to increase their cod landings in the future.

The unprofitable position of the otter trawlers is caused by their inability to produce sufficient revenue to cover all costs,

including a return to capital. When all variable costs are deducted, there is not enough revenue left to cover fixed expenses, depreciation and return to capital. We have pointed out that these vessels can operate profitably if annual landings are increased; average revenue increased and variable costs decreased. We have also shown how these objectives can be achieved by improving the utilization rates of the vessels, increasing operating efficiency and changing the species-mix of the catch.

The inshore cod fishery is plagued by excess labour and increasing capital as well as a declining amount of cod available for catching. The answer to this fishery's problems is not to be found in a continuation of past policies and practices. Limits and controls must be placed on the amount of labour and capital employed in catching cod on the inshore grounds. This situation will be the basis of our recommendations for the inshore fishery.

The offshore cod fishery will have two major tasks in the future. One will be to offset the decrease in Newfoundland's total cod catch caused by the inshore fishery's decline. The other will be to improve the operations of the otter trawler fleet so that this increased cod catch can be obtained economically.

We shall now recommend how the needed changes can be achieved in the inshore and offshore cod fisheries.

(ii) Recommendations for Development and Management

Up to this point we have dealt with the inshore and offshore cod fisheries separately. This was because of certain differences

that made similiar analysis of the two impossible or impractical. However, in the following pages we shall outline a joint scheme for improving the economic position of these fisheries. We shall prescribe measures for the inshore segment which are designed to overcome its peculiar problems, while the scheme for the offshore fishery will be directed to eleminating its difficutlies. However, measures taken in one fishery must be co-ordinated with those in the other.

To improve returns and control total fishing costs in the inshore cod fishery, effort must be reduced and regulated. This will become more and more important as less and less cod is available to the inshore gears. To regulate the number of men engaged is not by itself sufficient. Restrictions must also be placed on the amount of effort exerted, otherwise a reduced number of men will simply increase average effort, until most or all of any benefit resulting from reduced numbers is wiped out.

To improve average returns from this fishery, controls will have to be placed on the amount of codfishing effort in terms of boats and equipment as well as men engaged. This requires a drastic change in government policy which by subsidies, loans, and general encouragement has caused men to continue in, or enter into, the cod fishery. Subsidies on boats and fishing gear are not wrong in themselves; when made available to a fishery already troubled by surplus labour the result can only lead to a reduction in total returns.

Limitation of entry must, therefore, be coupled with a more selective subsidy programme or the complete abolition of such assistance. This type of government action is never popular and is even more unpopular if other employment opportunities are few. Such resistance will lessen as more jobs become available in other industries. However, in the meantime, the full scale continuance of such assistance programmes is only worsening an already bad situation.

In the short run there are some measures that will reduce the inshore cod fishing labour force even in the absence of limitations on entry. While these will not effectively solve the problem of surplus labour, they will somewhat alleviate its consequences. We have already discussed the continuing shortages of crew members for the offshore otter trawler fleet. To this can be added the need for labour in fish processing plants. For labour to be effectively used by these two activities it must be near to the processing plants and deep-sea ports. The Resettlement Programme which was enlarged with this purpose in mind, should be continued. When labour is moved from outlying isolated fishing settlements it should be encouraged to work in other industries such as deepsea fishing, fish processing, construction, manufacturing or services. If the movement of labour is effectively directed to centres where this is possible, some reduction in the inshore cod fishing manpower will be achieved in the short run.

Over time, as the supply of cod available inshore becomes

smaller, the decrease in effort must be continued. Eventually, improvements in the catching methods will become necessary to offset the effects of a declining amount of cod. This will require the use of gears like the otter trawl which can pursue the fish. Since these gears are more efficient than the types usually employed in the inshore cod fishery, their numbers must be less than those of traditional gears. When it becomes necessary to use gears of pursuit to maintain the inshore cod catch, there must be a further reduction in manpower. These developments must be subject to the methods of control that are imposed.

While no perfect system of regulating a sea fishery has yet been devised, the most effective of existing methods appears to be licencing. The major drawback of this, as with other types of regulations, is the difficulty of establishing the optimum level of fishing effort. The advantages of regulating a fishery by a licencing system are generally sufficient to justify its use rather than doing nothing at all. We shall now attempt to describe a licencing system for the Newfoundland inshore cod fishery, which at least will improve average returns.

Because of objections that will be raised to any restriction on inshore cod fishing the licencing system can be introduced in such a way that little reduction in men, boats and fishing gear results the first year or so. In the first year, licences will be issued to all cod fishing enterprises (crews) that earned more than a fixed amount from cod fishing the previous year.

Those earning less than the fixed amount will be immediately excluded from the cod fishery. The size of each crew can also be fixed at the level of the previous year so that those excluded by their previous year's earnings do not defeat the system by joining other crews. The number of boats and the amount of fishing gear used by the licenced crews will be set at the level used in the previous year.

After the first year of the licencing system, the number of men, boats, and fishing gear can be reduced by: (1) Revoking the licence of these crews earning less than a set amount, (2) Cancelling the licences of all enterprises or men retiring from the fishery. The amount of labour and equipment employed in the fishery can be reduced faster by raising the level of annual earnings required to keep a licence. This system cannot control the amount of time spent fishing but it can prevent the acquisition of more powerful boats and more efficient equipment. This does not mean the system will perpetuate inefficient technology, only that it can prevent the fishery from becoming overcapitalized.

The offshore cod fishery has a set of problems different from those of the inshore fishery. This fishery can produce increased landings and utilize more manpower and, in the long run, more capital. In the short run measures must be taken to improve the efficiency of the deepsea cod fishing fleet. Long term aims should be to increase the size of this fleet as required by the larger cod catch needed from offshore grounds.

The immediate problem of the offshore cod fishery is to improve the operations of the otter trawler fleet. This requires above all else the availability of sufficient skilled crew members. This improvement in manpower has two aspects; the labour must be trained and it must be available to the users. A greater contribution to training must come from the College of Fisheries, Navigation, Marine Engineering and Electronics. Making this labour available to the offshore fleet requires the efforts of the Resettlement Programme administrators and the Canada Manpower Centre. The trawler operators themselves could assist by increasing information on job opportunities in the offshore fishing industry.

In addition, the management personnel of the trawler operating companies should also be upgraded in methods of operating a fleet of vessels profitably. This requires that courses be available on this subject and that the personnel affected avail themselves of these.

Since the various deepsea trawler owners are making decisions on their own, the government must play an important role in co-ordinating or guiding the total offshore cod fishing activity. It could, for example, forestall any increase in the numbers of offshore vessels if the existing fleet is not used effeciently or at full capacity. This could be done by limiting the number of otter trawler licences. A government sponsored information service on fishing grounds, catches, etc. would also help the offshore fleet to operate more effectively.

The overall programme, therefore, should couple restricting the inshore effort with an expansion of offshore activity. Labour must be reduced in the inshore sector whereas capital must first be utilized more fully and then expanded in the offshore cod fishery. The long run aim should be for the offshore cod fleet to offset declining landings from the inshore cod fishery. If this is not done, continuing existing policies and practices will only worsen the present unsatisfactory situation.

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APPENDICES

APPENDIX 1

INSHORE AND OFFSHORE COD LANDINGS AND VALUES, NEWFOUNDLAND

BY YEAR, 1937 TO 1967

Year	TOTAL		INSHORE		OFFSHORE	
	Quantity ('000 lbs.)	Value ($'000)	Quantity ('000 lbs.)	Value ($'000)	Quantity ('000 lbs.)	Value ($'000)
1937	480,582	2,701	376,237	1,985	104,345	716
1938	520,763	2,762	425,078	2,079	95,685	683
1939	471,080	2,999	387,932	2,387	83,148	612
1940	416,684	3,422	331,080	2,696	85,604	726
1941	399,470	5,076	330,226	4,389	69,244	687
1942	348,707	5,237	322,122	4,865	26,585	373
1943	458,926	7,352	410,621	6,810	48,305	542
1944	517,287	8,133	467,791	7,553	49,496	580
1945	535,634	8,972	482,873	8,344	52,761	628
1946	540,011	9,282	482,406	8,533	57,605	749
1947	556,009	9,498	486,382	8,629	69,627	869
1948	470,973	8,377	406,165	7,516	64,808	861
1949	502,018	9,198	442,816	8,399	59,202	799
1950	422,522	8,232	396,466	7,748	26,056	484
1951	420,101	8,417	406,452	8,152	13,649	265
1952	391,764	8,581	370,776	8,123	20,988	459
1953	349,253	7,599	337,076	7,348	12,177	251
1954	441,435	9,751	419,582	9,286	21,853	465
1955	376,651	8,252	352,320	7,720	24,331	532
1956	398,250	8,882	382,972	8,574	15,278	308
1957	401,575	8,709	383,994	8,355	17,581	354
1958	300,086	6,360	286,176	6,037	13,910	323
1959	415,208	9,688	395,722	9,151	19,486	537
1960	406,333	10,344	388,242	9,913	18,091	431
1961	328,052	9,028	305,291	8,392	22,761	636
1962	374,553	10,945	352,614	10,337	21,939	608
1963	402,923	12,944	372,814	12,074	30,109	870
1964	369,603	13,693	321,291	12,186	48,312	1,507
1965	345,192	13,459	284,756	11,339	60,436	2,120
1966	344,540	14,590	279,440	12,051	65,100	2,539
1967	320,163	14,207	272,669	12,212	47,494	1,995

Sources: (1) Report of the Newfoundland Fisheries Board and General Review of the Fisheries, 1937 to 1948, Department of Natural Resources, Newfoundland Fisheries Board, St. John's.

(2) Information supplied by Economics Branch, Canada Department of Fisheries, St. John's.

APPENDIX 2

NUMBER OF INSHORE AND OFFSHORE COD FISHERMEN, BY YEAR (1)

NEWFOUNDLAND, 1937 TO 1967

YEAR	INSHORE	OFFSHORE	TOTAL
1937	20,434	1,839	22,273
1938	23,821	1,601	25,422
1939	23,596	1,624	25,220
1940	21,373	1,419	22,792
1941	17,217	1,426	18,643
1942	17,363	717	18,080
1943	19,153	866	20,019
1944	21,386	1,001	22,387
1945	23,998	864	24,862
1946	25,067	1,107	26,174
1947	26,751	1,399	28,150
1948	26,890	1,226	28,116
1949	25,658	1,274	28,932
1950	22,050	684	22,734
1951	20,850	341	21,191
1952	14,198	473	14,671
1953	13,433	520	13,953
1954	13,013	566	13,579
1955	12,560	572	12,132
1956	12,199	530	12,729
1957	13,853	554	14,407
1958	15,693	521	16,214
1959	15,800	527	16,327
1960	15,621	566	16,187
1961	15,553	603	16,156
1962	16,523	591	17,114
1963	17,653	698	18,351
1964	18,620	784	19,404
1965	17,390	933	18,323
1966	15,580	955	16,535
1967	14,717	1,229	15,946

Note: (1) Inshore fishermen are defined as men fishing on boats under 25 gross tons, offsnore fishermen as those on boats over 25 gross tons.

Sources: (1) Annual Reports of the Newfoundland Fisheries Board and General Review of the Fisheries, 1937 to 1948, Department of Natural Resources, St. John's.

(2) Reports on Men, Boats and Gear Employed in Primary Operations 1954, 1956 to 1967, Economics Branch, Canada Department of Fisheries, St. John's.

APPENDIX 3

COD LANDINGS AND VALUES PER INSHORE AND OFFSHORE COD FISHERMAN, NEWFOUNDLAND, BY YEAR, 1937 TO 1967

Year	TOTAL		INSHORE		OFFSHORE	
	Quantity (lbs.)	Value ($)	Quantity (lbs.)	Value ($)	Quantity (lbs.)	Value ($)
1937	21,577	121	18,412	97	56,740	389
1938	20,484	109	17,844	87	59,765	427
1939	18,679	119	16,441	101	51,200	376
1940	18,282	150	15,458	155	60,327	512
1941	21,427	272	19,180	255	45,558	482
1942	19,287	290	18,552	251	37,078	520
1943	22,924	367	21,439	356	55,779	626
1944	23,107	363	21,874	353	49,447	579
1945	21,544	361	20,121	348	61,066	727
1946	20,632	355	19,245	340	52,037	677
1947	19,752	337	18,182	323	49,769	621
1948	16,745	298	15,105	280	52,861	702
1949	18,640	342	17,258	327	46,469	627
1950	18,585	362	17,980	351	38,093	708
1951	19,825	397	19,494	391	40,026	777
1952	26,703	585	26,115	572	44,372	970
1953	25,031	545	25,093	547	23,417	483
1954	32,509	718	32,243	714	38,610	822
1955	28,682	628	28,051	615	42,537	930
1956	31,287	698	31,394	703	28,826	581
1957	27,874	604	27,719	603	31.735	639
1958	18,508	392	18,236	385	26,699	620
1959	25,431	593	25,046	579	36,975	1,019
1960	25,102	639	24,854	635	31,963	761
1961	20,305	559	19,629	540	37,746	1,055
1962	21,886	639	21,341	626	37,122	1,029
1963	21,956	705	21,119	684	43,136	1,246
1964	19,048	706	17,255	654	61,622	1,922
1965	18,839	735	16,375	652	64,776	2,272
1966	20,837	882	17,936	773	68,168	2,659
1967	20,078	891	18,527	830	38,644	1,623

Source: Appendices 1 and 2.

APPENDIX 4

AVERAGE LANDED VALUE PER POUND

FOR INSHORE, OFFSHORE AND TOTAL COD LANDINGS,

NEWFOUNDLAND, 1937 TO 1967

Year	Average Landed Value in Cents per Pound for		
	Total	Inshore	Offshore
1937	0.56	0.53	0.69
1938	0.53	0.49	0.71
1939	0.64	0.62	0.75
1940	0.82	0.81	0.85
1941	1.27	1.33	0.99
1942	1.50	1.51	1.40
1943	1.60	1.66	1.12
1944	1.57	1.61	1.17
1945	1.68	1.73	1.19
1946	1.72	1.77	1.30
1947	1.71	1.77	1.25
1948	1.78	1.85	1.33
1949	1.83	1.90	1.35
1950	1.95	2.28	1.86
1951	2.00	2.01	1.94
1952	2.19	2.19	2.10
1953	2.18	2.18	2.06
1954	2.21	2.21	2.12
1955	2.19	2.19	2.18
1956	2.23	2.24	2.02
1957	2.17	2.18	2.01
1958	2.12	2.11	2.32
1959	2.33	2.31	2.76
1960	2.55	2.55	2.38
1961	2.75	2.75	2.79
1962	2.92	2.93	2.77
1963	3.21	3.24	2.89
1964	3.70	3.79	3.12
1965	3.90	3.98	3.64
1966	4.23	4.31	3.90
1967	4.24	4.47	4.20

Source: Appendix 2

APPENDIX 5

VALUE OF CAPITAL EQUIPMENT EMPLOYED IN THE INSHORE AND OFFSHORE COD FISHERIES, NEWFOUNDLAND, BY YEAR, 1954 TO 1967

Year	Inshore ($'000)	Offshore ($'000)	Total ($'000)
1954	5,464.7(1)	5,697.0	11,161.7
1955	--	--	--
1956	6,137.5	5,315.8	11,453.3
1957	6,972.2	5,182.6	12,154.8
1958	8,006.7	4,911.5	12,918.2
1959	8,496.7	4,770.2	13,266.9
1960	8,228.2	6,075.2	14,303.4
1961	8,647.9	5,220.8	13,868.7
1962	9,709.3	5,803.6	15,512.9
1963	11,362.0	9,007.0	20,369.0
1964	12,807.0	10,154.0	22,961.0
1965	15,437.0	15,267.0	30,704.0
1966	16,035.0	18,881.0	34,916.0
1967	18,666.0	39,300.0	57,966.0

-- Not available

Note: (1) Does not include value of gill nets.

Source: Canada Department of Fisheries, Economics Branch, St. John's, Newfoundland.

APPENDIX 6

VALUE OF CAPITAL EQUIPMENT, PER FISHERMAN, EMPLOYED IN INSHORE AND OFFSHORE COD FISHERIES, NEWFOUNDLAND, 1954 TO 1967

Year	Inshore ($)	Offshore ($)	Total ($)
1954	420	10,065	822
1955	--	--	--
1956	503	10,030	890
1957	503	9,355	844
1958	510	9,427	797
1959	538	9,052	813
1960	527	10,734	884
1961	556	8,658	858
1962	588	9,820	906
1963	644	12,904	1,110
1964	688	12,952	1,183
1965	888	16,749	1,676
1966	1,029	19,771	2,112
1967	1,268	31,977	3,635

-- not available

Source: Appendices 2 and 5

Note: These measures of capital per man are only gross calculations and are not meant to be precise. For example, in the case of the inshore cod fishery, all inshore boats and all gear that can take cod are attributed to the cod fishery when in fact they are also used in other fisheries. The same applies to the offshore cod fishery. These qualifications should be noted when these data are referred to.

APPENDIX 7

LANDINGS AND LANDED VALUE PER DOLLAR OF CAPITAL EMPLOYED IN INSHORE AND OFFSHORE COD FISHERIES NEWFOUNDLAND, 1954-1967

Year	INSHORE		OFFSHORE	
	Landings/Capital (lbs.)	Value/Capital ($)	Landings/Capital (lbs.)	Value/Capital ($)
1954	77.0	1.70	3.8	0.08
1955	--	--	--	--
1956	62.4	1.40	2.9	0.06
1957	55.1	1.20	3.4	0.07
1958	35.7	0.75	2.8	0.07
1959	46.6	1.08	4.1	0.11
1960	47.2	1.20	3.0	0.07
1961	35.3	1.09	4.4	0.12
1962	36.3	1.06	3.8	0.10
1963	32.8	1.07	3.3	0.10
1964	25.1	0.95	4.8	0.15
1965	18.4	0.73	4.0	0.14
1966	17.4	0.75	3.4	0.13
1967	14.6	0.65	1.2	0.05

-- Not available.

Source: Appendices 1 and 5

Note: These measures of capital per man are only gross calculations and are not meant to be precise. For example, in the case of the inshore cod fishery, all inshore boats and all gear that can take cod are attributed to the cod fishery when in fact they are also used in other fisheries. The same applies to the offshore cod fishery. These qualifications should be noted when these data are referred to.

APPENDIX 8

COMPARISON OF CURRENT AND CONSTANT[1] INSHORE AND OFFSHORE COD LANDED VALUES TOTAL AND PER FISHERMAN, BY YEAR, NEWFOUNDLAND, 1951 TO 1967

Year	INSHORE COD LANDED VALUES				OFFSHORE COD LANDED VALUES			
	Total Value		Value Per Man		Total Value		Value Per Man	
	Current ($'000)	Constant ($'000)	Current ($)	Constant ($)	Current ($'000)	Constant ($'000)	Current ($)	Constant ($)
1951	8,152	8,152	391	391	265	265	777	777
1952	8,123	7,848	572	553	459	443	970	937
1953	7,348	7,190	547	535	251	246	483	473
1954	9,286	9,026	714	694	465	452	822	799
1955	7,720	7,409	615	590	532	511	930	893
1956	8,574	8,028	703	658	308	288	581	544
1957	8,355	7,637	603	551	354	324	639	584
1958	6,037	5,390	385	344	323	288	620	554
1959	9,151	8,006	579	507	537	470	1,019	892
1960	9,913	8,583	635	550	431	373	761	659
1961	8,932	7,191	540	463	636	545	1,055	904
1962	10,337	8,790	626	532	608	517	1,029	875
1963	12,074	10,062	684	570	870	725	1,246	1,038
1964	12,186	10,046	654	539	1,507	1,242	1,922	1,584
1965	11,339	9,211	652	530	2,120	1,722	2,272	1,846
1966	12,051	9,564	773	613	2,539	2,015	2,659	2,110
1967	12,212	9,437	830	641	1,995	1,542	1,623	1,254

Note: (1) Deflated by Consumer Price Index, St. John's, Nfld. (1950 = 100)

Sources: (1) Appendices 1 and 3

(2) Regional Office, Dominion Bureau of Statistics, St. John's

~~APPENDIX 9~~

(1)

MONTHLY INSHORE COD LANDINGS BY TYPE OF GEAR AS PERCENT OF ANNUAL TOTALS, ICNAF DIVISIONS, 3K, 3L, 3Ps, 3Pn AND 4R, 1964

Month	Total Catch	Catch By T	GN	HL	J	LL	Unknown
January	0.5	-	-	-	Ø	1.8	5.6
February	1.5	-	-	-	0.6	5.3	4.3
March	1.4	-	0.1	-	0.3	5.2	3.8
April	1.9	-	0.2	-	1.1	6.4	65.9
May	2.2	Ø	3.9	-	4.3	4.2	-
June	20.5	32.2	17.5	19.2	25.4	6.5	-
July	37.4	60.4	37.6	19.9	34.7	10.7	-
August	17.9	7.2	27.4	35.3	23.4	18.8	-
September	9.5	0.2	9.7	20.5	8.2	19.6	-
October	5.6	-	3.3	4.6	1.6	16.1	-
November	1.2	-	0.2	0.5	0.2	3.9	-
December	0.4	-	Ø	Ø	0.2	1.5	20.4
Amounts ('000 lbs.)	369,496	140,226	85,811	29,328	13,442	100,156	533

T - Cod Trap, GN - Gill Net, HL - Handline, J - Jigger, LL - Longline and/or trawl line

Ø = Less than 0.1 per cent

Note: (1) Inshore here includes all boats under 25 gross tons plus all longliners over 25 gross tons.

~~Source: Appendix 15.~~

~~APPENDIX 10~~

(1)

MONTHLY INSHORE COD LANDINGS BY TYPE OF GEAR AS PERCENT OF ANNUAL TOTALS, ICNAF DIVISIONS 3K, 3L, 3Ps, 3Pn AND 4R, 1965

Month	Total Landings	Taken By					
		T	GN	HL	J	LL	Unknown
January	0.6	-	-	0.1	0.4	2.0	3.3
February	2.1	-	-	0.1	2.0	6.9	2.7
March	2.1	-	-	-	1.7	7.2	3.2
April	2.1	-	0.2	0.1	0.3	6.4	17.6
May	4.0	1.0	5.4	0.2	0.4	6.6	27.4
June	20.9	37.9	17.1	18.7	22.2	6.2	-
July	35.0	53.4	41.7	28.2	31.4	11.0	-
August	15.7	7.8	21.4	27.3	26.9	15.6	-
September	10.6	-	11.5	22.1	10.1	19.2	-
October	4.5	-	2.6	2.9	0.8	12.5	-
November	1.7	-	0.1	0.2	0.8	5.0	20.1
December	0.8	-	-	-	2.9	1.4	25.7
Amount ('000 lbs.)	298,857	97,710	80,460	23,661	9,437	84,194	3,395

T - Cod Trap, GN - Gill Net, HL - Handline, J - Jiggers, LL - Longline and/or Trawl Line.

Note: (1) Inshore here includes all boats under 25 gross tons plus all longliners over 25 gross tons.

Source: ~~Appendix 16~~

~~APPENDIX 11~~

(1)

MONTHLY INSHORE COD LANDINGS BY TYPE OF GEAR AS PERCENT OF ANNUAL TOTALS, ICNAF DIVISIONS 3K, 3L, 3Ps, 3Pn AND 4R, 1966

Month	Total Catch	Taken By					
		T	GN	HL	J	LL	Unknown
January	0.6	-	-	-	1.0	2.2	0.1
February	1.3	-	-	-	0.8	4.5	-
March	2.1	-	-	-	0.4	7.6	0.7
April	2.6	-	1.4	0.2	-	7.1	6.5
May	4.9	7.1	2.7	-	17.4	5.1	18.0
June	26.4	48.8	24.1	24.5	16.7	10.9	3.5
July	27.6	42.0	36.0	17.5	24.6	10.4	2.1
August	15.4	2.0	23.1	35.9	14.4	12.5	5.8
September	9.9	0.1	8.8	18.3	9.2	17.9	4.8
October	5.6	-	2.9	3.4	15.6	13.8	6.5
November	2.7	-	0.8	0.1	-	6.9	25.6
December	0.8	-	0.1	-	-	1.1	26.3
Amount ('000 lbs.)	293,124	77,121	90,625	30,995	7,699	80,907	5,777

T - Cod Trap, GN - Gill Net, HL - Handline, J - Jiggers, LL - Longline and/or Trawl Line.

Note: (1) Inshore here includes all boats under 25 gross tons plus all longliners over 25 gross tons.

Source: ~~Appendix 17~~

APPENDIX 12
(1)

PERCENTAGE OF MONTHLY INSHORE COD LANDINGS TAKEN BY TYPE OF GEAR

ICNAF DIVISIONS, 3K, 3L, 3Ps, 3Pn AND 4R, 1964

Month	Total Amount Landed ('000 lbs.)	Percent of Monthly Catch Taken by					
		T	GN	HL	J	LL	Unknown
January	1,850	-	-	-	0.2	98.2	1.6
February	5,443	-	-	-	1.5	98.1	0.4
March	5,350	-	2.0	-	0.7	96.9	0.4
April	7,047	-	2.6	-	2.0	90.4	5.0
May	8,231	0.4	41.0	-	7.1	51.5	-
June	75,713	59.6	19.9	7.4	4.5	8.6	-
July	138,208	61.3	23.4	4.2	3.4	7.7	-
August	65,963	15.3	35.7	15.7	4.8	28.6	-
September	35,220	0.6	23.5	17.1	3.1	55.6	-
October	20,515	-	13.9	6.6	1.0	78.5	-
November	4,320	-	3.6	3.5	0.8	92.0	-
December	1,636	-	0.5	1.0	1.8	90.0	6.7
Totals	369,496	38.0	23.2	7.9	3.6	27.1	0.1

T - Cod Trap, GN - Gill Net, HL - Handline, J - Jiggers, LL - Longline and/or Trawl Line.

Note: (1) Inshore here includes all boats under 25 gross tons plus all longliners over 25 gross tons.

Source: Appendix 15.

APPENDIX 13
(1)

PERCENTAGE OF MONTHLY INSHORE COD LANDINGS TAKEN BY TYPE OF GEAR, ICNAF DIVISIONS 3K, 3L, 3Ps, 3Pn AND 4R, 1965

Month	Total Landings ('000 lbs.)	Percent of Monthly Catch Taken By					
		T	GN	HL	J	LL	Unknown
January	1,834	-	-	1.9	2.3	89.7	6.1
February	6,148	-	-	0.6	3.1	94.9	1.5
March	6,328	-	-	-	2.6	95.7	1.7
April	6,196	-	2.2	0.5	0.5	87.2	9.6
May	11,969	8.2	36.6	0.4	0.3	46.7	7.8
June	62,523	59.2	22.0	7.1	3.4	8.4	-
July	104,597	49.9	32.0	6.4	2.8	8.8	-
August	46,799	16.0	36.8	13.8	5.4	28.0	-
September	31,580	-	29.4	16.6	3.0	51.0	-
October	13,417	-	15.8	5.2	0.5	78.5	-
November	5,107	-	1.5	1.0	1.6	82.6	13.4
December	2,359	-	-	-	11.4	51.6	37.0
Total	298,857	32.7	26.9	7.9	3.2	28.2	1.1

T - Cod Trap, GN - Gill Net, HL - Handline, J - Jiggers, LL - Longline and/or Trawl Line

Note: (1) Inshore here includes all boats under 25 gross tons plus all longliners over 25 gross tons.

Source: Appendix 17

APPENDIX 14
(1)

PERCENTAGE OF MONTHLY INSHORE COD LANDINGS TAKEN BY TYPE OF GEAR, ICNAF DIVISIONS, 3K, 3L, 3Ps, 3Pn AND 4R, 1966

Month	Total Landings ('000 lbs.)	Percent of Monthly Catch Taken By					
		T	GN	HL	J	LL	Unknown
January	1,831	-	-	-	4.1	95.6	0.3
February	3,741	-	-	-	1.7	98.3	-
March	6,187	-	-	-	0.5	98.8	0.7
April	7,518	-	17.6	1.0	-	76.6	4.9
May	14,473	37.9	17.1	-	9.2	28.6	7.2
June	77,410	48.6	28.2	9.8	1.7	11.4	0.3
July	80,885	40.0	40.4	6.7	2.3	10.4	0.1
August	45,164	3.3	46.3	24.6	2.5	22.5	0.7
September	29,237	0.4	27.2	19.4	2.4	49.7	0.9
October	16,385	-	16.0	6.4	7.3	68.0	2.3
November	7,841	-	9.7	0.6	-	70.8	18.9
December	2,452	-	2.2	-	-	35.8	62.1
Totals	293,124	26.3	30.9	10.6	2.6	27.6	2.0

T - Cod Trap, GN - Gill Net, HL - Handline, J - Jiggers, LL - Longline and/or Trawl Line.

Note: (1) Inshore here includes all boats under 25 gross tons plus all longliners over 25 gross tons.

Source: Appendix 17

APPENDIX 15

(1)

MONTHLY INSHORE COD LANDINGS, BY TYPE OF GEAR,

ICNAF DIVISIONS, 3K, 3L, 3Ps, 3Pn, AND 4R, 1964

(Quantities in '000 lbs.)

MONTH	TOTAL	Amount Taken By					
		T	GN	HL	J	LL	Unknown
January	1,850	-	-	-	4	1,816	30
February	5,443	-	-	-	82	5,338	23
March	5,350	-	108	-	36	5,186	20
April	7,047	-	182	-	146	6,368	351
May	8,231	29	3,378	-	581	4,243	-
June	75,713	45,147	15,030	5,621	3,408	6,507	-
July	138,208	84,728	32,282	5,835	4,663	10,700	-
August	65,963	10,105	23,522	10,344	3,147	18,845	-
September	35,220	217	8,287	6,018	1,099	19,599	-
October	20,515	-	2,860	1,344	212	16,099	-
November	4,320	-	154	150	33	3,983	-
December	1,636	-	8	16	31	1,472	109
Totals	369,496	140,226	85,811	29,328	13,442	100,156	533

T - Cod Trap - GN - Gill Net, HL - Handline, J - Jiggers, LL - Longline and/or Trawl Line.

Note: (1) Inshore here includes all boats under 25 gross tons plus all longliners over 25 gross tons.

Source: Canada Department of Fisheries, Economics Branch, St. John's, Nfld.

~~APPENDIX 16~~

(1)

MONTHLY INSHORE COD LANDINGS, BY TYPE OF GEAR,

ICNAF DIVISIONS 3K, 3L, 3Ps, 3Pn AND 4R, 1965

(quantities in '000 lbs.)

Month	Total Landings	Landings Taken By					
		T	GN	HL	J	LL	Unknown
January	1,834	-	-	34	42	1,646	112
February	6,148	-	-	34	191	5,832	91
March	6,328	-	-	-	165	6,055	108
April	6,196	-	139	28	28	5,045	596
May	11,969	984	4,379	49	36	5,589	932
June	62,523	37,029	13,739	4,418	2,096	5,241	-
July	104,597	52,200	33,519	6,667	2,967	9,244	-
August	46,799	7,497	17,209	6,453	2,539	13,101	-
September	31,580	-	9,283	5,234	950	16,113	-
October	13,417	-	2,117	694	73	10,533	-
November	5,107	-	75	50	80	4,218	684
December	2,359	-	-	-	270	1,217	872
Totals	298,857	97,710	80,460	23,661	9,437	84,194	3,395

T - Cod Trap, GN - Gill Net, HL - Handline, J - Jiggers, LL - Longline and/or Trawl Line.

Note: (1) Inshore here includes all boats under 25 gross tons plus all longliners over 25 gross tons.

~~Source: Ibid.~~

APPENDIX ~~17~~

(1)

INSHORE COD LANDINGS BY TYPE OF GEAR, BY MONTH,

ICNAF DIVISIONS, 3K, 3L, 3Ps, 3Pn AND 4R, 1966
(quantities in '000 lbs.)

Month	Total Landings	Landings Taken By					
		T	GN	HL	J	LL	Unknown
January	1,831	-	-	-	75	1,751	5
February	3,741	-	-	-	62	4,950	-
March	6,187	-	-	-	31	6,113	43
April	7,518	-	1,312	73	-	5,758	375
May	14,473	5,487	2,468	-	1,337	4,142	1,039
June	77,410	37,630	21,852	7,609	1,282	8,832	205
July	80,885	32,389	32,665	5,423	1,890	8,399	119
August	45,164	1,511	20,935	11,131	1,109	10,144	334
September	29,237	104	7,961	5,663	711	14,522	276
October	16,385	-	2,617	1,052	1,202	11,136	378
November	7,841	-	762	44	-	5,554	1,481
December	2,452	-	53	-	-	877	1,522
Totals	293,124	77,121	90,625	30,995	7,699	80,907	5,777

T - Cod Trap, Gn - Gill Net, HL - Handline, J - Jiggers, LL -Longline and/or Trawl Line.

Note: (1) Inshore here includes all boats under 25 gross tons plus all longliners over 25 gross tons.

Source: Ibid.

APPENDIX 18

(1)
INSHORE COD LANDINGS BY TYPE OF GEAR, BY MONTH,

ICNAF DIVISIONS, 3K, 3L, 3Ps, 3Pn AND 4R, 1964-1966 AVERAGES

(quantities in '000 lbs.)

Month	Total	Amount Taken By					
		T	GN	HL	J	LL	Unknown
January	1,838	-	-	11	40	1,738	49
February	5,111	-	- -	11	112	4,950	38
March	5,955	-	36	-	77	5,785	57
April	6,920	-	544	34	58	5,844	440
May	11,556	2,166	3,408	16	651	4,658	657
June	71,881	39,935	16,874	5,882	2,262	6,860	68
July	107,897	56,439	32,822	5,975	3,173	9,448	40
August	52,641	6,371	20,555	9,309	2,265	14,030	111
September	32,012	107	8,510	5,638	920	16,745	92
October	16,772	-	2,531	1,030	496	12,589	126
November	5,756	-	330	81	38	4,585	722
December	2,148	-	20	5	100	1,189	834
Totals	320,487	105,018	85,630	27,992	10,192	88,421	3,234

T - Cod Trap, GN - Gill Net, HL - Handline, J - Jiggers, LL - Longline and/or Trawl Line.

Note: (1) Inshore here includes all boats under 25 gross tons plus all longliners over 25 gross tons.

Source: Appendices 15, 16, and 17.

APPENDIX 19

COMPARISON OF ACTUAL FINANCIAL PERFORMANCE WITH A PROJECTED BREAKEVEN PERFORMANCE FOR NEWFOUNDLAND 130 FOOT SIDE TRAWLERS

	Actual[1]	Breakeven
Annual Landings (lbs.)	5,310,780	7,270,000
Average Revenue (¢)	3.07	3.75
Total Revenue ($)	163,189	252,600
Average Variable Cost (¢)	2.97	2.75
Total Variable Cost[2] ($)	157,898	168,400
Fixed Expenses and Depreciation[3] ($)	37,406	37,400
Return to Capital ($)	-32,115	35,300[4]

Notes: (1) Based on 1966 and 1967 data contained in "Costs and Earnings of Selected Fishing Enterprises, Newfoundland," see source below.

(2) Variable cost is taken as Maintenance and Repair and other operating Expenditures plus payments to crew.

(3) Taken at actual level.

(4) Taken as 7 per cent of total capital invested, therefore, includes subsidy payments.

Source: Proskie, J., Costs and Earnings of Selected Fishing Vessels, Preliminary Reports, 1966 and 1967, Department of Fisheries of Canada, Ottawa.

APPENDIX 20

COMPARISON OF ACTUAL AND PROJECTED BREAKEVEN OPERATING EFFICIENCY OF NEWFOUNDLAND 130 FOOT SIDE TRAWLERS

	Actual[1]	Breakeven
Annual Landings (lbs.)	5,310,780	7,270,000
Number of Trips	26.5	29
Landings per Trip (lbs.)	200,407	250,690
Number of Days at Sea[2]	253.5	290[5]
Catch per Day at Sea (lbs.)	20,950	25,069
Number of Days Fished[3]	182.5	232[5]
Catch per Day Fished (lbs.)	29,100	31,336
Number of Hours Fished[4]	2,413	4,454[5]
Catch per Hour Fished (lbs.)	2,201	1,632
Days at Sea per Trip	9.57	10
Days Fished per Trip	6.89	8
Hours Fished per Day at Sea	9.51	15
Hours Fished per Day Fished	13.22	19

Notes: (1) Based on 1966 and 1967 data contained in "Costs and Earnings of Selected Fishing Enterprises, Newfoundland."

(2) From date sailed to date landed.

(3) Days in which catching operations take place, could be different from days on grounds if vessel must heave to because of stormy weather.

(4) Hours in which catching operations take place .

(5) Calculated at "80 per cent availability level".

Source: Ibid.

APPENDIX 21

SPECIES LANDED IN 1966 AND 1967 BY NEWFOUNDLAND 130 FOOT SIDE TRAWLERS WITH AVERAGE PRICE HIGHER THAN PROJECTED BREAKEVEN AVERAGE REVENUE

Species, Size & Form	Price (¢) per Pound 1966(1)	1967
Cod, unsized, round	-	3.75
Cod, unsized, gutted head on	3,92	3.96
Haddock, unsized, gutted head on	5.10	4.59
Haddock, large, gutted head on	5.85	6.00
Haddock, jumbo, gutted head on	6.00	-
Haddock, medium, gutted head on	4.00	-
Haddock, small, gutted head on	4.71	4.00
Halibut, unsized, gutted head off	15.80	17.85
Halibut, unsized, gutted head on	17.95	17.91
Turbot, unsized, gutted head on	-	4.00
Turbot, unsized, round	-	4.00
Greysole, unsized, round	-	3.82
Flounders, unsized, gutted head on	-	4.17
Weighted Average of All these Species	4.27	4.08

Note: (1) In 1966 one trawler landed a trip in Nova Scotia, these prices are not listed.

Source: Ibid.

APPENDIX 22

COMPARISON OF ACTUAL FINANCIAL PERFORMANCE WITH A PROJECTED BREAKEVEN PERFORMANCE FOR NEWFOUNDLAND 148 FOOT STERN TRAWLERS

	Actual (1)	Breakeven
Annual Landings (lbs.)	4,976,179	10,464,000
Average Revenue (¢)	3.50	4.25
Total Revenue ($)	174,188	444,720
Average Variable Cost (¢)	3.56	3.00
Total Variable Cost ($) (2)	177,329	313,920
Fixed Expenses and Depreciation ($) (3)	63,319	63,300
Return to Capital ($)	-66,460	67,500 (4)

Notes (1) Based on 1966 and 1967 data contained in "Costs and Earnings of Selected Fishing Enterprises, Newfoundland."

(2) Variable cost is taken as Maintenance and Repair and other operating Expenditures plus payments to crew.

(3) Taken at actual level.

(4) Taken as 7 per cent of total capital invested, therefore, includes subsidy payments.

Source: Ibid.

APPENDIX 23

COMPARISON OF ACTUAL AND A' PROJECTED BREAKEVEN OPERATING EFFICIENCY OF NFLD. 148 FOOT STERN TRAWLERS

	Actual (1)	Breakeven
Annual Landings (lbs.)	4,976,179	10,464,000
Number of Trips	21	29
Landings per Trip (lbs.)	236,961	360,828
Number of Days at Sea (2)	190	290 (5)
Catch per Day at Sea (lbs.)	26,190	36,083
Number of Days Fished (3)	144	232 (5)
Catch per Day Fished (lbs.)	34,557	45,104
Number of Hours Fished (4)	2,137	4,454 (5)
Catch per Hour Fished (lbs.)	2,329	2,349
Days at Sea per Trip	9.05	10
Days Fished per Trip	6.86	8
Hours Fished per Day at Sea	11.25	15
Hours Fished per Day Fished	14.84	19

Notes (1) Based on 1967 data contained in "Costs and Earnings of Selected Fishing Enterprises, Newfoundland".

(2) From date sailed to date landed.

(3) Days in which catching operations take place. Could be different from days on grounds if vessel must heave to because of stormy weather.

(4) Hours in which catching operations take place.

(5) Calculated at "80 per cent availability level".

Source: Ibid, 1967 Report

APPENDIX 24

SPECIES LANDED IN 1967 BY NEWFOUNDLAND 148 FOOT STERN TRAWLERS WHICH WERE PRICED HIGHER THAN THE PROJECTED BREAKEVEN AVERAGE REVENUE

Species, Size and Form	1967 Price per Pound (¢)
Cod, market, gutted head on	4.25
Cod, steak, gutted head on	4.50
Halibut, unsized, gutted head on	15.00
Halibut, unsized, gutted head on	15.01
Halibut, snapper, gutted head off	17.00
Halibut, chicken, gutted head off	20.00
Flounders, unsized, gutted head on	4.25
Weighed Average of these Prices	4.39

Source: Ibid, 1967 Report