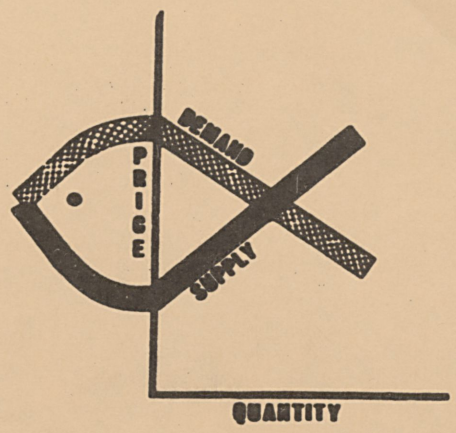

NOT FOR QUOTATION

The Effects of Imports on United States Groundfish Prices

by

John J. Houtsma

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U.S. NATIONAL MARINE FISHERIES SERVICE
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THE EFFECTS OF IMPORTS ON UNITED STATES GROUNDFISH PRICES

by

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A thesis submitted to the Faculty of Graduate Studies and Research in partial fulfillment of the requirements for the degree of Master of Arts.

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ABSTRACT

THE EFFECTS OF IMPORTS ON UNITED STATES GROUNDFISH PRICES

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This study estimates the magnitude of the effect of the increase in groundfish imports on U.S. groundfish prices. The estimate is based on an analysis of the changes in supply and demand in the U.S. landings market.

The short-run was found to be perfectly inelastic; changes in supply are therefore equal to changes in landings. The single-equation model was used to estimate several demand equations for the wholesale level and the implications for the landings level were derived. The following demand equation gave the best fit:

$$\log Qfsp = -.61 \underset{(.17)}{-.46 \log \frac{Pfsp^*}{Pm\&p}} + \underset{(.26)}{.26 \log Y} + \underset{(.012)}{.044 D_1^{**}} + \underset{(.003)}{.013 D_2 t^{**}}$$

*Significant at 0.05 level
**Significant at 0.01 level

R^2 (Adjusted) =95.7
Durbin-Watson d = 1.83

The conclusions of the study are:

1. The decline of U.S. groundfish prices in the 1950's resulted from two factors: the drop in meat and poultry prices and the increase in imports, with the latter causing prices to drop by less than 8.1 percent.
2. The effects of imports on U.S. groundfish prices have been grossly overestimated in a recent study by the U.S. Bureau of Commercial Fisheries.

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PREFACE

The United States groundfish industry has been a declining industry for the past two decades. The growing unprofitability of the groundfish fishery and its effects on new investment and employment are matters of considerable concern not only to the members of the industry and closely related industries, but also to Government officials. The objective of this study is to assess the role of one of the factors that has contributed to the cost-price squeeze which underlies the growing unprofitability, namely the increase in imports of groundfish products.

Various studies have pointed to the increase in imports as one of the causes of the decline. There have also been a number of investigations by the U.S. Tariff Commission. In a recent study, the U.S. Bureau of Commercial Fisheries went as far as attributing the full decline in groundfish prices in the 1950's to the increase in imports.

There is no doubt that the increase in imports of groundfish has had an effect on the U.S. prices of this product. The important question is: how much? This study presents an estimate of the magnitude of this effect which is based on analysis of the changes in supply and demand in the U.S. groundfish landings market.

This study was undertaken under the supervision of Dr. C.B. Haver. His approach, suggestions, and criticisms have been of great value, and I wish to express my gratitude for his involvement. I also

benefitted from the advice and helpful criticisms of Dr. E.F. Beach and Dr. J. Kurien. I have greatly appreciate these opportunities to raise questions and test ideas.

I found discussions with members of the industry and officials of the Canada Department of Fisheries and the U.S. Bureau of Commercial Fisheries most helpful. In particular I would like to thank Mr. H. Frick and Dr. D.A. Nash for their interest in this study.

Most of the writing took place in Sackville, N.B. Dr. W.B. Cunningham read a draft of this paper and made valuable comments for which I am most grateful. I also would like to thank Miss Louise Smith who performed the task of typing cheerfully and efficiently.

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CHAPTER I

INTRODUCTION

Imports of groundfish products into the United States date back to well before the 1940's, although the quantities were small. During the war they increased substantially reaching 50 million pounds in 1946. Further increases took place in 1950 and 1951. Until 1953 these imports took the form of fillets, most of which were frozen. In the second half of 1953 a new groundfish product, called fish sticks appeared on the market.[1] A relatively small quantity (6.5 million pounds) of the main raw material for fish sticks, called fish slabs or fish blocks, was imported in that year.[2]

Fish sticks were an immediate success and the imports of fish blocks increased to fifty million pounds in 1954. In 1955 and 1956 fish stick sales stagnated due to quality deterioration and the imports of blocks remained at the 1954 level. It was not until 1961 that the sales of fish sticks started to show an upward trend.

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[1] Fish sticks are elongated pieces of fish flesh, generally cut from a fish block. Fish sticks weigh between .75 and 1.25 ounces and are at least three-eighths inch thick. They are sold fresh and frozen, cooked and uncooked, and breaded or plain.

[2] Fish blocks are fish fillets and small pieces of fish flesh, called "bits and pieces", frozen into blocks, each weighing ten pounds or more.

In the meantime the imports of fish blocks had received a boost from the introduction of another new groundfish product, called fish portions.[3] Fish portions gained general consumer acceptance in 1958, but unlike fish sticks, its sales continued to increase in the following years. Two related reasons can be given. 1) The product was backed by considerable advertising in publications reaching the institutional market place and 2) new retail outlets adopted the product and new markets were developed.

The introduction of fish sticks caused the sales of fresh and frozen fillets to decline. The average annual consumption of fillets dropped from 262.0 million pounds for 1950-53 to 248.6 million pounds for 1954-57. On the other hand, the introduction of fish portions did not affect this total; the average annual fillet consumption for 1958-67 is 249.5 million pounds.

Imports of fresh and frozen fillets were not significantly affected by the sales of fish sticks and portions. Imports increased substantially during the war, as was already pointed out. But it was not until 1951 that they approached the level at which they would remain during the 1950's and part of the 1960's. Average annual imports of fillets were 100.2 million pounds for 1951-53, 96.3 million pounds for 1954-57 and 102.8 million pounds for 1958-67.

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[3]Fish portions are pieces of fish flesh, generally of uniform size, with a thickness of three-eighths inch or more, which does not conform to the definition of a fish stick. Like fish sticks, portions are usually cut from a fish block and are sold fresh and frozen, cooked and uncooked, and breaded or plain.

This study deals with the effects of imports on the United States groundfish industry. Or, more precisely, it deals with the effect of imports on the incomes earned by the vessel owners and crewmembers of the U.S. groundfish fishery. The total (bruto) income of this fishery is made up of the product of the landings price and the quantity of the catch. Imports affect this income because they affect the demand for and therefore the price of the landed fish.

Landings prices in the United States show a significant decline in 1953 and 1954. For most species the landings price did not return to the 1952 level until 1958. In a recent study the United States Bureau of Commercial Fisheries estimated this price decline to be 1.6 cents per pound (28 percent) and attributed it to the increase in imports.[4] The validity of the analysis and conclusions found in the Report seemed most doubtful to the present writer who at the time of publication was carrying out an analysis of demand for groundfish products in the U.S. market. The reason for questioning the findings of the Bureau was simply that the substantial decline in the prices of the main substitutes for groundfish products (meat and poultry) which took place in 1953, was not even mentioned in the Report.

Most researchers would probably agree that findings which

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[4]Department of the Interior, Report of the Secretary of the Interior to the President and the Congress on The Effects of Imports on the United States Groundfish Industry. (Washington, D.C., May 1969), pp. 48-60.

do not reflect reality are of no use to policy makers and can only lead to improper policies. It was this consideration that led to the decision to make the demand analysis a tool rather than a goal, i.e. to use the knowledge of demand and (short run) supply in the landings market to determine the effect of increased imports on landings prices.

On at least four occasions since 1950 the domestic fishery has sought policy changes.[5] The results of the four investigations of the U.S. Tariff Commission will be briefly summarized. The result of the first investigation (1952) was a decision by the Tariff Commission in favour of no action. The second and third investigations led to the following recommendations (of the Tariff Commission): a flat duty of 2.5 cents per pound plus a quota of 37 percent of the average annual consumption of the last five years (1954) and the maximum permissible increase in duties (1956). In both cases President Eisenhower declined to impose the recommended restrictions. The result of a fourth investigation (held under the authority of the Trade Expansion Act of 1962) was that groundfish fillets and steaks were reserved from negotiations in the Kennedy Round.

In view of the recent evidence of the growing support in the United States for the protectionist principle in international

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[5]Department of the Interior. Report of the Secretary of the Interior to the President and the Congress on The Effects of Imports on the United States Groundfish Industry, p. 80.

trade, it would seem likely that requests for another enquiry will be soon forthcoming.[6] And the nature of the recommendation of the Tariff Commission is not difficult to predict if it were to accept the findings of the Bureau. In view of the extent of the involvement of the Bureau in research in the area of fisheries economics, it would seem that the Tariff Commission would have little choice. However, it would be most unfortunate if such a recommendation was made on the basis of invalid research findings.

The question of the effect of imports on landings prices is of considerable interest to Canada. Canada is the main source of imports of groundfish fillets and blocks. Therefore, a substantial part of the consequences of the import restriction would be born by the Canadian fishery in general, and the Atlantic region in particular. The general scarcity of alternative employment opportunities in this region adds to the seriousness of such consequences.

A brief outline of this study follows. A review of the literature on the short run supply in fisheries yielded the (undocumented) statement that landings are not influenced by the current price. If this were so and if the same would be true at the higher levels of demand, the single-equation method could be used to estimate demand functions. Therefore, the first

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[6] Concern about the increasing support for the protectionist principle in the United States is reflected in a front-page article in the Halifx Chronicle-Herald of July 16, 1970, entitled "Canada Upset about U.S. Trade Attitude".

assignment was to study the nature of the supply in the short run. Chapter II reviews the literature on this subject and develops the theory. And Chapter III presents an analysis of the relation between the quantities of inputs and the price of output in the New England groundfish fishery.

In Chapter IV the literature on the demand for groundfish products is briefly reviewed as well as the conditions that have to be fulfilled for the Single-Equation model to yield valid estimates of the structural parameters of demand functions. And the question whether these conditions are met in the groundfish industry is studied. The last part of Chapter IV presents empirical analyses of demand for groundfish in the United States at the wholesale level.

In the first part of Chapter V an estimate is made of the magnitude of the decline in landings prices and the effect of the change in supply in the landings market on these prices. The factors that influenced the demand in the landings market is determined with aid of data on imports and the findings of Chapter IV. The decline in landings prices is attributed to the factors that caused the change in demand, yielding a quantitative estimate of the effect of the increase in imports on U.S. landings prices. The last chapter summarizes the findings of this study.

CHAPTER II

THE NATURE OF THE SUPPLY OF GROUNDFISH IN THE SHORT-RUN

The basic question of this Chapter and the next is whether the supply of groundfish to the processor (groundfish landings) in a certain fishing season is related to the landings price in that season, the maximum duration of which would be one year.

This chapter consists of two parts. The first part reviews the literature on this subject. The second part develops the theory of the supply to the landings market. This chapter is closely related to Chapter III which presents an empirical analysis of the short-run supply.

Little or no empirical work has been done on this subject as the review of the literature will show. The reason for this could be that the answer to the question posed has been considered to be self-evident by those who are knowledgeable about the industry. Since the answer is critical to whether the single equation method used in Chapter IV is appropriate for the analysis of demand, it was desirable to study the nature of the short-run supply more closely. Data for the New England landings market for the period 1947-1957 are used for this purpose. The results of this analysis are found in the next chapter.

Review of the Literature

The supply in fisheries is one of the subjects discussed by Alfred Marshall in his Principles of Economics.[1] Marshall, who is one of the few economists to touch upon this subject, used fisheries primarily to illustrate that the predictions made by economic analysis depend on the time horizon under consideration: the predictions for the "short period" differ from those for the "long period".

Marshall did not address himself to the particular question raised in this paper, the relation between inputs and the price of output in the same year, and his "short period" should not be equated with the short run as defined for the purpose of this study. To illustrate this, it should be pointed out that Marshall, in fact, distinguished three periods,[2] one of which (the shortest) did not receive a name. He states:

> We may roughly classify problems connected with fishing industries as those which are affected by very quick changes, such as uncertainties of the weather; or by changes of moderate length, during the year or two following a cattle plague [the short period]; or lastly we may consider the great increase during a whole generation of the demand for fish which might result from the rapid growth of a high-strung artisan population making little use of their muscles [the long period].

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[1] A. Marshall, Principles of Economics, (8th. ed., 1962 reprint; London: Macmillan Co. Ltd., 1962), pp. 307-09.

[2] It is interesting to note that the need for an analysis in terms of three time-periods (short, medium and long run) was stressed by a participant in the discussion of a more recent paper dealing with the supply of fish. See R. Turvey and J. Wiseman (eds.), The Economics of Fisheries, (Rome: United Nations, Food and Agricultural Organization, 1957), pp. 13-14.

In one paragraph Marshall dealt with his first period. In it one observes the "day to day oscillations of the price of fish resulting from uncertainties of the weather, etc." but the period is too short for the "normal" (equilibrium) level of price to be affected perceptibly. Marshall did not elaborate on the length of this period or on which other factors, represented by the "etc.", might be expected to cause the price to oscillate.

In the "short period" the equilibrium price can change. This period may extend over a period of a few years. Marshall states that if demand increases the quantity supplied may also be expected to increase, because sailors may be induced to switch to the fishery for a year or two, old fishing boats may be put back into service and vessels which were not specially made for fishing may be adapted and sent to fish for a year or two.

How does the subject matter of this chapter and the next relate to Marshall's analysis? Basically this study concentrates on Marshall's first period; an attempt is made to determine the minimum length of this period. More specifically, the question that is being asked is whether the quantity of inputs and therefore the quantity supplied may be expected to respond to changes in the price of the output within the same year.

The nature of the supply curve of fish was the first of a number of subjects discussed at a Round Table organized by the International Economic Association in Rome, September 1956.[3] At

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[3] Ibid., pp. 1-17.

this meeting Professor Gerhardsen of the Norwegian School of Economics presented a paper, entitled "A Note on Costs in Fisheries", in which he touched upon the elasticity of supply in the short and long run.

Right from the start Gerhardsen made it clear that little work had been done on the subject and that all he could contribute were some examples and general principles. Gerhardsen stated that examples of rising cost curves could be easily given if the quantity supplied was to be increased at short notices. However, he did not elaborate on the minimum length of the "short notice". But he did give an example, the Norwegian winter herring fishery, where an increase in demand would not change the quantity supplied during the season.[4]

During the discussion Professor Crutchfield made the proposition that input-output relationships were so unstable in fishing that short- or even long-run maximizing behaviour of the traditional kind was not relevant to the fishing industry. A similar thought was reflected by Professor Turvey, editor of The Economics of Fisheries, in his introduction to this book:

> The prevalence of the share system and the riskiness of the industry make analysis in terms of short-run supply curves rather difficult. Firstly, the quantity risk means that the relation between inputs (and thus cost) on the one hand and output on the other is stochastic. Secondly, the price risk means that the value of any given size of catch cannot be known in advance, so that today's price can hardly be represented as determining today's input in any simple manner. Thirdly, the share

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[4] Ibid., p. 14.

> element in labour remuneration makes an important item of cost dependent upon demand, so that cost and revenue are not independent.
>
> To a large extent, however, these difficulties have more to do with the geometry of supply curves than with understanding the fishing industry. Even within a fishing season, particularly good catches or high prices may stimulate some increase in inputs: for example by boats putting to sea in poor weather when the catch is likely to be lower than usual. The possibilities naturally vary between fisheries, but in general a greater responsiveness might be expected to favourable expectations held before a season commences. For example, fishing may begin earlier, multi-purpose fishing boats may be shifted from other uses, laid-up boats may be put in commission again, and so on.[5]

The analysis presented in Chapter III confirms Turvey's opinion expressed in the second paragraph, that "in general a greater responsiveness might be expected to favourable expectations held before a season commences".

In the same discussion the need to distinguish the responsiveness of supply of different kinds of fish was stressed by Gerhardsen and Crutchfield. Crutchfield added that in Canada increased demand would in most instances lead to increased effort and larger catches, but he did not touch on the time lag between the two.

Farrel and Lampe, and F. W. Bell give clear answers to the specific question of this chapter. Farrel and Lampe write:

> Given the fleets, the catch appears to be functionally related most closely to the movements, growth and decline of the fish populations and the weather. There is little attempt by the fishermen to influence landings prices by deliberate variation of quantities landed. The quantity landed may thus be viewed

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[5] Ibid., p. vi.

> as independent of price variables over the short period; i.e. within the annual fishing cycle.[6]

And Bell states:

> The independent variables [of the annual demand functions to be estimated] may be justified as exogenous on an a priori basis. Landings and imports are not responsive to short run fluctuations in ex vessel prices. National income and the price of competing products [meat and poultry] may be considered independent of ex vessel fish prices.

In a footnote on the same page he says:

> Demand analysis usually suffers from the identification problem in which the supply and the demand curve are difficult to disentangle. In the case of the demand for fish, the supply curve may be assumed completely inelastic in the short run. Although the supply curve may shift over the longer period it will "trace out" the demand curve as long as income is held constant in the demand equation.[7]

These are very clear and complete answers to the question raised in this chapter. However it seems that Bell had second thoughts on the length of the short-run. In 1968 he writes:

> Of special importance, the quantity landed is functionally related to the movement of fish populations and the weather. There is little attempt by fishermen to influence landings prices by deliberate variation in the quantity landed. In the short run, the supply function is completely inelastic and shifts in this function should "trace out" the demand curve.

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[6] J. F. Farrell, and H. C. Lampe, The New England Fishing Industry: Functional Markets for Finned Food Fish I, Economics of Marine Resources, Paper No. 2, Kingston, Rhode Island: (University of Rhode Island, 1965), p. 6.

[7] F. W. Bell, The Economics of the New England Fishing Industry: The Role of Technological Change and Government Aid, (Research Report to the Federal Reserve Bank of Boston, No. 31. 1966), p. 38.

> and, since we are using monthly observations, the period is approximately the short run.[8] (emphasis added)

Mr. John Proskie of the Department of Fisheries of Canada does not share Bell's second thoughts. For many years Mr. Proskie has analyzed, and written about, the performance of Canadian fishing vessels.[9] In reply to a question, in which the short run was defined as one fishing season (maximum one year), he gave his unqualified opinion: "Yes, there is completely inelastic supply in the short run." The same view prevails in the industry. Vessel owners, in answer to the question whether the efforts of their crew and vessels were related to the current landings price, indicated that this was not the case.

Supply to the Landings Market

The purpose of studying the supply side of the landings market is to determine whether the quantity of fish landed in the short run is affected by the price of landed fish in that period. In the

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[8] F. W. Bell, "The Pope and the Price of Fish", The American Economic Review, Vol. LVlll No. 5, Part 1 (December, 1968).

[9] See e.g. John Proskie, Operations of Modern Longliners and Draggers Atlantic Seaboard, 1952-1958, Primary Industry Studies, No. 1, Vol. 8, (Ottawa: Department of Fisheries of Canada, 1960).

John Proskie, Operations of Modern Fishing Craft Atlantic Seaboard 1959, Primary Industry Studies, No. 1, Vol. 9, (Ottawa: Department of Fisheries of Canada, 1961).

John Proskie, Cost of Earnings of Selected Fishing Enterprises Atlantic Provinces, 1961-66, Primary Industry Studies, No. 1 Vols. 11-16, (Ottawa: Department of Fisheries of Canada, various years, 1963-69).

short run, given the resource base (fish stocks and their age structure) and weather conditions, the quantity of fish landed will obviously depend upon the efforts made in catching fish. Therefore the answer to the question whether landings are influenced by their price in the short-run depends on whether the catching effort (the input into the catching operation) is related to the price of landings in the short run.

Vessel owners may be looked upon as owners of the firms which supply fish to the landings market. Most firms in other industries work with a price for the labour input which is agreed upon before the production process starts and which is not directly dependent on the value of the final product that this factor helps to produce. This is not the case in the catching operation. Here the remuneration of labour is a given percentage of the value of final product, after certain expenses have been deducted.[10] This arrangement takes part of the risk[11] involved in the catching operation away from the vessel owner and places it on the shoulders of the individual fisherman, who thus becomes a partner in the catching venture.

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[10] For more detail on the share arrangements between vessel owners and the crew see "The Lay System", in V. J. Norton and M. M. Miller, An Economic Study of the Boston Large Trawler Labor Force, Circular 248, Bureau of Commercial Fisheries, (Washington: Department of the Interior, May, 1966), p. 30.

[11] In this context I do not distinguish between risk and uncertainty. In the catching operation there is considerable uncertainty about the quantity of the catch as well as its price. A contract with a processor would eliminate the latter, but the former has to be born by the entrepreneur. The entrepreneurial function, as has been pointed out, is being shared by the vessel owner and the crewmen.

The quantity of inputs in fishing during a certain period depends on:

1. The number of fishermen
2. (a) The capacity of the fleet (the number and net tonnage of the fishing vessels)

   (b) The quantity of gear and equipment
3. The number of days fished per vessel per season.

With regard to 2(b), the quantity of gear and equipment, there are serious measurement problems.[12] Therefore, I have made the assumption that the quantity of gear and equipment is roughly proportional to the number (or net tonnage) of the vessels. There is ground for believing that this assumption is a realistic one. In trawling, which is the predominant technique employed by New England fishermen in catching groundfish, one boat can handle only one net, the size of which depends on the size of the vessel and the capacity of its engine. Furthermore, technology in fishing has not changed to any great extent.[13]

The supply of factors of production is one of the least developed subjects in price theory. However, one generalization which is generally accepted states that the supply of a factor to a certain industry depends on the price paid for the factor by

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[12] E.g. There is a great variety of fish finding devices with considerable differences in capacity and price.

[13] Bell observes: "The slow growth of labor productivity is certainly not surprising since groundfish vessels and their equipment have not changed greatly over the postwar period".

F. W. Bell, The Economics of the New England Fishing Industry, p. 10.

firms in other industries which hire similar factors.

In fishing, the price paid for the services of the factors (vessels as well as labour) is determined by the value of the catch, after certain expenses have been deducted. The value of the catch is the product of the landings price and the quantity landed per vessel. In turn, the average quantity landed per vessel depends on the average effort per vessel and the properties of the resource base.

The total annual effort per vessel is made up of the product of the number of days at sea per year and the average number of hours fished per day. It is not unrealistic to assume that the number of hours fished per day at sea is reasonably constant, because the opportunity cost of fishing, once the vessel is at sea, is low and is easily exceeded by the value of the catch. Therefore, it seems unlikely that during the trip the number of hours fished per day will be less than that of a regular full day of fishing. Whether the number of days at sea per person varies with landings prices will be investigated in the next chapter. The conclusion is that this is not the case to any significant extent. The total effort per year per vessel may therefore be regarded as reasonably stable. Any fluctuations that do occur will, for the greater part, have to be attributed to an exogenous factor: weather conditions.

If the effort per vessel is reasonably stable, we are left with one variable affecting the quantity landed per vessel: the properties of the resource base. Our problem is now reduced to finding

a measure of the properties of the resource base.

It may be stated that the properties of the resource base would be reflected in the average annual landings per vessel if the total annual effort per vessel were reasonably stable and if the degree of exploitation of the resource did not change drastically. As has been indicated above, the first condition has been satisfied. We will now check the second.

The groundfish resource of the Atlantic is exploited by the United States, Canada and a number of European Countries. There is reason to believe that the degree of exploitation of this resource has not altered a great deal until the late 1950's. The New England effort did not change substantially over the period 1947-57. (See Table 1, Chapter 111) For Canada there are no accurate landings statistics prior to 1953, since this was the first year for which relatively complete data were available for Newfoundland. The landings in 1953 were around 20 percent below those of the following years which might create the impression that the Canadian effort increased after this year. This is however not correct because 1953 was a particularly bad year from the point of view of the volume of the catch. The New England catch was also considerably smaller than usual (20 percent below the 1947-54 average). Between 1954 and 1964 the Canadian groundfish landings continually fluctuated between 900 and 1000 million pounds.[14] This indicates that the extent to which Canada

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[14] Department of Fisheries and Forestry, Economic Intelligence and Statistics Division Fisheries Service, Annual Statistical Review of Canadian Fisheries, Vol. 1, 1953-68, (Ottawa, 1969), p. 16.

has exploited the fish stocks of the Atlantic has been reasonably stable during the period 1953-57. In the late 1950's the effects of considerably increased effort (and increased landings) by some European countries became clearly noticeable,[15] but this falls outside our period of observation.

Our conclusion therefore is that since both the total effort per vessel per year and the degree of exploitation of the resource seem to have been reasonably stable over the period 1947-57, the average landings per vessel do reflect the properties of the resource.

Introducing this conclusion into the discussion of what factors influence the earnings of the factors of production in fishing, it can be stated that there are two: the price of landings and the state of the resource which is reflected in average landings per vessel per year.

We will now turn to the factors which determine the remuneration in alternative employment opportunities. It would be difficult to determine which alternative would be available to crew members of New England groundfish vessels and what their pay would be. However, as long as this pay is above a certain level, the relative ease or difficulty of finding another job may be a much more important variable.

An indicator of the relative scarcity or abundance of alternate

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[15] See, e.g., C.R. Molson, et. al. An assessment of the Resource Inventory in Newfoundland Waters, A Report prepared for the Supervisory Committee on Fisheries Development, (St. John's, Newfoundland; December, 1963).

jobs is the rate of unemployment in New England. This variable also reflects to some extent what happens to the general wage level; in years with little unemployment the general wage level tends to rise more rapidly than in years with high unemployment. It is for these reasons that the rate of unemployment has been selected as an indicator of alternative employment opportunities of fishermen.

There are not nearly as many alternatives for the vessel as for most crew members. Most vessel owners are faced with the following alternatives: 1) catching groundfish, 2) moving into another fishery (which in most cases involves major expenditures due to alterations to the vessels and the purchase of other gear) or 3) tying up the vessel. But the decision to switch to another fishery is generally made before the season starts, on the basis of past experience. This leaves only two alternatives for the short-run: catching groundfish or tying up.

The decision whether or not to make use of the vessel in a certain year is not only determined by earnings but also may be expected to depend on the availability of crew members. The latter, as has already been pointed out, is influenced by the availability of alternative jobs, as measured by the rate of unemployment. Therefore the rate of unemployment may be expected to influence the capacity of the fleet.

In summary, three variables which may be expected to influence

the quantities of the inputs of the catching operation have been isolated. They are: 1) the price of landings, 2) the state of the resource as measured by landings per vessel, or landings per man and 3) the availability of alternative jobs to crew members as measured by the rate of unemployment in the United States. The next chapter pursues the primary question of the influence of landings prices on the short-run quantity of inputs.

CHAPTER 111

THE RELATION BETWEEN INPUTS AND THE PRICE OF OUTPUT IN THE NEW ENGLAND GROUNDFISH FISHERY, 1947-1957

In this chapter we will study the inputs of the New England catching operation during the period 1947-57 and relate their quantities to the three determining variables in order to determine whether these quantities in a certain season are affected by the price of landed fish in that season.

New England was chosen because most groundfish landings take place in this region as a comparison between its landings and those for the whole Atlantic Coast shows (See Table 1). Furthermore data on inputs, output and landings prices are readily available.

The period 1947-57 contains a number of significant landings price changes and therefore provides opportunities to observe the reactions of the inputs to these changes. The analysis could not be carried out for later years because part of the data required are not available. However this does not appear to be a serious shortcoming: ample evidence was found of the existence of a lag in the relationship between inputs and landings prices, and until there is a considerable improvement in the ability to predict future prices, it would seem unlikely for the nature of this lag to change.

The data inputs, output and productivity per unit of input have been summarized in Table 1.

TABLE 1

THE NEW ENGLAND GROUNDFISH FISHERY

	INPUT		OUTPUT				PRODUCTIVITY	
							Landings Per	
Year	Vessels[1]	Fishermen[2]	Groundfish[3]	Flounder	Total	(Total)[4]	Vessel	Man
	(Number)	(Number)	(Landings in Millions of Pounds)					
1947	742	4928	414.0	67.5	481.5	(513.2)	648.9	97.7
1948	727	4812	523.5	71.8	595.3	(616.9)	818.2	123.6
1949	719	4779	517.8	66.8	584.6	(607.4)	813.1	122.3
1950	672	4512	465.8	66.8	532.6	(552.7)	792.6	118.0
1951	795	5298	502.3	60.5	562.8	(579.7)	707.9	106.2
1952	769	4732	439.1	55.4	494.5	(511.4)	643.0	104.5
1953	776	4714	364.8	47.3	412.1	(429.2)	531.1	87.4
1954	759	4561	404.8	47.5	452.3	(471.3)	595.9	99.2
1955	684	4009	363.6	50.1	413.7	(431.8)	604.8	103.2
1956	675	3905	376.8	47.9	424.7	(445.6)	629.2	108.8
1957	649	3689	331.5	53.9	385.4	(404.6)	593.8	104.5
		Av. 1947-52:	477.0	64.8	541.8			
		Av. 1953-57:	368.3	49.3	419.6			

[1]Otter trawlers (vessels over 5 net tons).

[2]Employment on otter trawlers.

[3]Species that have traditionally been included in this term: cod, cusk, haddock, hake, pollock and ocean perch.

[4]Totals for the Atlantic Coast.

Source: Bureau of Commercial Fisheries, Fishery Statistics of the U.S. 1947-57, (Washington: Government Printing Office).

The Capacity of the Fleet

Table 2 shows that the capacity of the New England trawler fleet fluctuated around the 27 thousand ton mark during the period 1947-52 and reached its peak in 1954 (29,217 tons). In 1955 after two years of relatively low landings prices the net average dropped considerably, down to 25,328 tons. In each of the following two years it dropped an additional 800 tons. It is interesting to notice when comparing the two periods 1947-52 (before the drop in landings prices) and 1953-57 (the period with low landings prices) that the average net tonnage was almost the same in these two periods (26,900 and 26,300, a drop of 2.2 percent) not withstanding the drop in prices. An analysis of the year to year changes in the capacity of the fleet reveals that there is a lagged relation between changes in it and changes in landings prices. Various instances can be pointed out to illustrate this.

In 1949 landings prices dropped considerably, but the net tonnage remained the same. The downward adjustment in the latter (7.7 percent) did not take place until 1950, notwithstanding the fact that in that year prices (nominal as well as real) had returned to the 1948 level. Output per vessel had been stable around the 800,000 pound level since 1948. And judging from the rate of unemployment in 1949 and 1950 (8.2 and 5.2 percent respectively), it does not seem likely that the vessel owners would have had unusual difficulty in manning their vessels.

TABLE 2

THE NEW ENGLAND GROUNDFISH FISHERY: CAPACITY OF THE FLEET AND RELATED VARIABLES 1947-57

Year	Vessels		Price of Landings				Output	Av. Profit	Unemployment
	V (Number)	T (Tonnage)	P_L[1] (Cents per Pound)	P_L[2] / IPwh	IP_L[3] (57-59=100)	IP_L[4] / IPwh	Per Vessel	Per Vessel Before Taxes (Dollars)	in New England (percent)
1947	742	27,602	5.85	103.5	82.3	101.4	648.9	n.a.	n.a.
1948	727	26,794	6.02	105.7	90.9	103.4	818.2	n.a.	n.a.
1949	719	26,657	5.23	90.2	82.2	98.4	813.1	n.a.	8.2
1950	672	24,597	6.14	101.6	90.3	104.0	792.6	+ 5,000	5.2
1951	795	28,220	6.65	98.8	101.5	105.0	707.9	+13,069	3.5
1952	769	27,580	6.59	100.6	97.1	103.3	643.0	+ 6,605	3.5
1953	776	29,028	6.21	96.2	90.9	98.1	531.1	- 1,706	2.9
1954	759	29,217	5.75	89.0	86.0	92.6	595.9	- 2,289	4.9
1955	684	25,328	5.64	86.9	83.6	89.7	604.8	- 2,431	3.4
1956	675	24,545	5.69	84.9	84.9	88.3	629.2	- 3,525	2.7
1957	649	23,726	6.44	93.4	91.0	91.9	593.8	- 8,300	3.9

[1]Average price per pound, obtained by dividing total landed value by the quantity of landings.

[2]The index reflecting the average price per pound (57-59=100) divided by the wholesale price index for all items.

[3]Index of landings prices. Constant weights (average quantities) were used in constructing this index.

[4]Index of landings prices divided by the wholesale price index for all items.

Source: F.W. Bell, The Economics of the New England Fishing Industry: The Role of Technological Change and Government Aid, Research Report to the Technical Reserve Bank of Boston, No. 31, 1966.

Bureau of Commercial Fisheries, Fishery Statistics of the United States, 1947-57.

U.S. Department of Labor, Bureau of Employment Security, The Labor Market and Employment Security, 1949-57.

Therefore the reduction in the capacity of the fleet in 1950 can only be attributed to the drop in landings prices in the previous year.

The effect of the price increase in 1950 was not felt until 1951 when the net tonnage increased by 14.7 percent. Landings per vessel had not increased. As a matter of fact they started to decline slightly in 1950 and were considerably lower in 1951. The labour market had become tighter in 1951; the rate of unemployment had dropped to 3.5 percent. Neither of these factors therefore could account for the increase in the capacity of the fleet. One other possiblity remains; if the vessel owners suffered from money illusion, the increase in the capacity of the fleet could be attributed to increased money prices in the year 1951 itself (real prices however, increased by only one percent). In the light of the other cases this seems an unlikely explanation.

A further increase in capacity to 29,000 tons in 1953 has to be attributed to relatively high landings prices in the previous years. Landings prices in 1953 dropped by over five percent, output per vessel had been declining and the rate of unemployment had been relatively low since 1951. Therefore none of these factors could account for it.

In 1954 landings prices continued to fall and vessel owners went into their second year of losses. But the capacity of the fleet was not adjusted until 1955. Again this adjustment can only

be attributed to lower landings prices in the previous year(s). The output per vessel as well as the rate of unemployment was higher in 1954 and 1955 than in 1953.

In summary the period 1947-57 provides four examples of a lagged reaction of changes in the capacity of the fleet to changes in the landings price, the lag being one year. In two cases there was an increase and in two cases a decrease in the capacity of the fleet which had resulted from a change in the landings price in the same direction in the previous year. This evidence supports the hypothesis that the capacity of the fleet in a certain year depends on the landings prices of the previous year.

The results of regression analyses also point to the existence of a lagged relationship between the capacity of the fleet and landings prices and therefore confirm our conclusion. These results have been listed in Table 3.

Two different sets of landings prices have been used. An "A" before the equation number indicates that the average price per pound, obtained by dividing the total landed value by the quantity of landings, was used. A "B" indicates the use of the index of landings prices. The second digit shows whether landings prices were lagged one year (an "1") or not (an "0"). An "1" as the third digit indicates deflation by the wholesale price index for all items.

The parameters which have been estimated were the α and β

TABLE 3

SUMMARIZED RESULTS OF REGRESSION ANALYSES

Equation	Dependent Variable	a	P_{L_t}	$P_{L_{t-1}}$	$\left(\frac{P_L}{IPwh}\right)_t$	$\left(\frac{P_L}{IPwh}\right)_{t-1}$	R^2	F
A 1.0	V_t	520.3	33.9 (35.1)				9.3	.9
A 1.1	V_t	145.7		96.5** (22.8)			69.2	17.9
B 1.0	V_t	404.9	3.58 (2.34)				20.6	2.3
B 1.1	V_t	213.1		5.7* (1.9)			53.9	9.0
A 1.01	V_t	454.8			2.8 (2.4)		13.9	1.5
A 1.11	V_t	101.8				6.5** (1.4)	74.3	23.1
B 1.01	V_t	321.4			4.1 (2.2)		27.6	3.4
B 1.11	V_t	54.0				6.8** (1.6)	68.1	17.0

* Significant at 0.05 level
** Significant at 0.01 level

of the following equation:

$$V_t = \alpha + \beta_1 P_t$$

where: V_t = the number of vessels

P_{L_t} = the landings price

Alternate dependent variables used were:

$P_{L_{t-1}}$ = the landings price with a lag of one year

$\left(\frac{P_L}{IPwh}\right)_t$ = the landings price deflated by the wholesale price index of all items

$\left(\frac{P_L}{IPwh}\right)_{t-1}$ = the delated landings price with a lag of one year

The results are quite straightforward and clear. None of the parameters in the equations with the current landings price, whether or not deflated, was statistically significant. On the other hand all the parameters of the equations with a lagged landings price were statistically significant at the 95 percent level. Deflation by the wholesale price index improved the "fit" (higher values for R^2 and F) as might be expected. The deflated index of landings prices with a one year lag can explain 68.1 percent of the fluctuation in the number of vessels (B 1.11). For the average price per pound (deflated, lagged) this percentage is 74.3 (A 1.11).

The same analyses, using the net tonnage (T_t) instead of the

number of vessels (V_t) as the dependent variable, give similar results, as Table 4 shows. This could be expected because of the close relationship between the number of vessels and their net tonnage.

The Number of Fishermen

The changes in the number of fishermen in the New England groundfish fishery reflect to a considerable extent the changes in the capacity of the fleet, as might be expected. Naturally the two are by no means independent and it would be difficult to determine the direction of cause and effect.

Although the two series are closely related they are not identical (See Table 1). In most years when the number of vessels increased, so did the number of fishermen, and vice versa. However whereas the number of vessels reached its peak in 1953 (1954 for the net tonnage) the number of fishermen employed by the New England fleet is the greatest in 1951. In other words, the increase in the capacity of the fleet in 1953 and 1954 did not involve additional fishermen.

There is nevertheless considerable similarity in the lagged reaction of both variables to changes in landings prices. Table 5 shows the number of fishermen and related variables. We observed that the most likely explanation for the drop in the capacity of the fleet in 1950 was the drop in landings prices in 1949. The

TABLE 4

SUMMARIZED RESULTS OF REGRESSION ANALYSES

Equation	Dependent Variable	a	P_{L_t}	$P_{L_{t-1}}$	$\left(\frac{P_L}{IPwh}\right)_t$	$\left(\frac{P_L}{IPwh}\right)_{t-1}$	R^2	F
A 2.0	T_t		R[1]					
A 2.1	T_t	4.77		3.65** (.91)			66.5	15.9
B 2.0	T_t	20.80	.07 (.10)				4.6	.4
B 2.1	T_t	8.02		.21* (.08)			47.3	7.2
A 2.01	T_t	19.52			.07 (.09)		6.5	.6
A 2.11	T_t	3.69				.24** (.06)	67.9	17.0
B 2.01	T_t	15.38			.12 (.09)		14.3	1.5
B 2.11	T_t	2.91				.24** (.07)	57.4	10.8

[1]Variable has been removed; $F < .005$

* Significant at 0.05 level
** Significant at 0.01 level

TABLE 5

NEW ENGLAND GROUNDFISH FISHERY: LABOUR INPUT AND RELATED VARIABLES 1947-57

Year	Fishermen	Price of Landings[1]				Output	Earnings Per Man		Unemployment
	F (Number)	P_L (Cents per Pound)	$\frac{P_L}{IPwh}$	IP_L (57-59=100)	$\frac{IP_L}{IPwh}$	Per Man (Thousand Pounds)	Av.Share (in dollars)	Ratio[2]	in New England (Percent)
1947	4,928	5.85	103.3	82.3	101.4	97.7	n.a.	n.a.	n.a.
1948	4,812	6.02	98.3	90.9	103.4	123.6	n.a.	n.a.	n.a.
1949	4,779	5.23	89.8	82.2	98.4	122.3	n.a.	n.a.	8.2
1950	4,512	6.14	101.5	90.3	104.0	118.0	3,161	1.05	5.2
1951	5,298	6.65	98.7	101.5	105.0	106.2	3,200	.99	3.5
1952	4,732	6.59	100.6	97.1	103.3	104.5	3,142	.92	3.5
1953	4,714	6.21	96.1	90.9	98.1	87.4	2,542	.71	2.9
1954	4,561	5.75	88.8	86.0	92.6	99.2	2,745	.75	4.9
1955	4,009	5.64	86.8	83.6	89.7	103.2	2,868	.75	3.4
1956	3,905	5.69	84.8	84.6	88.3	108.8	3,042	.75	2.7
1957	3,689	6.44	93.3	91.0	91.9	104.5	3,374	.80	3.9

[1] See footnotes of Table 2.

[2] Ratio of fisherman's earnings to annual earnings per employee in the U.S.

Source: See Table 2.

same applies to the drop in number of fishermen in 1950 (5.6 percent). Output per man did not change between 1948 and 1950 and alternative jobs were hard to find (rate of unemployment in 1949, 8.2 percent; in 1950, 5.2 percent). Therefore these two variables could not explain the decline.

The increase in the fleet in 1951 was attributed to the relatively high landings prices in 1950. The same factor no doubt played an important role in the substantial increase in the number of fishermen in 1950 (17 percent), although the relatively high rate of unemployment in 1949 and 1950 may also have contributed to it. The impact of the latter would depend on the lag between the changes in rate of unemployment and changes in the number of fishermen. The drop in the rate of unemployment in 1951 to 3.5 percent points to a considerable increase in the number of alternative job opportunities in that year. The increase in the number of fishermen in 1951 could definitely not be attributed to changes in the resource: the output per man had been declining since 1948.

In 1952 the number of fishermen dropped by 10.7 percent even though landings prices reached a peak in the previous year and continued to stay very close to that level. The most probable reason that can be given for the drop is the availability of other jobs; the rate of unemployment in 1951 and 1952 was 3.5 percent.

Another substantial decrease in the number of fishermen (12.7 percent) took place in 1955, after two years of falling prices. Output per man was particularly low in 1953 but in 1954 it came close to the level of 1951 and 1952. The earnings of individuals in other jobs continued to increase particularly in the years 1951-53 when the rate of unemployment was close to three percent. The combined effect of dropping landings prices, a relatively low output per man, and increasing wages in other jobs was a drop in the ratio of fisherman's earnings to the average earnings per employee, to parity in 1950-52 (the ratio for 1950 was 1.05, 1951: .99 and 1952: .92).

In 1957 nominal and real landings prices increased and so did the ratio of earnings, but there was another drop in the number of fishermen (5.5 percent). Output per man was the same as in the previous two years. The rate of unemployment increased from 2.7 percent in 1956 to 3.9 percent in 1957. Again the low landings prices in the preceeding year(s) are most likely the reason for this drop.

Summarizing our findings, we have observed three cases in which considerable changes in the number of fishermen (one increase and two decreases) could only be attributed to changes in landings prices in the previous year. In one further case when landings prices remained the same the increased availability of other jobs could explain a drop in the number of fishermen,

and in one case an increase in landings prices and a decrease in the number of fishermen were observed for the same year. This evidence clearly shows the existence of a lag of one year in the relationship between landings prices and the number of fishermen engaged in the fishery.

Regression analyses similar to the ones applied to the capacity of the fleet were carried out. The number of fishermen (F_t) was related to the same independent variables as the ones used in the previous analyses. The results are also of the same nature. They are found in Table 6.

The parameters of the undeflated landings prices (the average per pound as well as the index) are not statistically significant whether a lag is introduced (A 3.1, B 3.1) or not (A 3.0, B 3.0). However deflation by the wholesale price index alters the situation. This indicates that fishermen are not suffering from money illusion; particularly the parameters of the deflated lagged landings prices are highly significant (A 3.11 and B 3.11). When the index of landings prices is used with a lag of one year, 87.6 percent of the fluctuation in the number of fishermen is explained by this variable (B 3.11).

One problem remains. When the deflated landings prices are not lagged, its parameters are also statistically significant (A 3.01, B 3.01). Does this mean that the existence of a lag is to be questioned after all? The answer is plainly "no".

TABLE 6

SUMMARIZED RESULTS OF REGRESSION ANALYSES

Equation	Dependent Variable	a	P_{L_t}	$P_{L_{t-1}}$	$\left(\frac{P_L}{IPwh}\right)_t$	$\left(\frac{P_L}{IPwh}\right)_{t-1}$	R^2	F
A 3.0	F_t	3259.6	212.7 (359.8)				3.7	.3
A 3.1	F_t	1260.1		542.2 (345.9)			23.5	2.5
B 3.0	F_t	1888.0	29.7 (24.1)				14.4	1.5
B 3.1	F_t	1631.4		32.3 (24.3)			18.1	1.8
A 3.01	F_t	140.1			46.4* (19.9)		37.6	5.4
A 3.11	F_t	-1814.5				66.6** (10.7)	82.3	38.4
B 3.01	F_t	-1755.1			64.4** (14.6)		68.3	19.4
B 3.11	F_t	-2808.9				74.3** (9.9)	87.6	56.6

* Significant at 0.05 level
** Significant at 0.01 level

Statistically significant parameters will be obtained in any case in which regression analysis is applied to two variables that both have a clear trend, whether or not there is any relation between the two. Our results of A 3.01 and B 3.01 are examples of this. The deflated landings prices have a downward trend and the number of fishermen has also been gradually declining.

The way to tackle this problem is to take explicit account of the trend. For this purpose a trend variable "t" has been incorporated in the equation which now reads as:

$$F_t = f\left(\left(\frac{PL}{IPwh}\right)_t, t\right) \qquad \text{(A 3.02 and B 3.02)}$$

And in the other two regressions (A 3.12 and B 3.12) the price variable has been lagged.

The results are found in Table 7. The parameters of the deflated landings prices are not statistically significant (A 3.02 and B 3.02) whereas those of the same variable with a lag are highly significant (A 3.12 and B 3.12).

The results of these regression analyses therefore confirm our conclusion, which is supported by various cases outlined above, that the number of fishermen of this year depends on the (real) landings prices of last year.

The Number of Days at Sea Per Vessel, Per Year

Information pertaining to the activity of large and medium

TABLE 7

SUMMARIZED RESULTS OF REGRESSION ANALYSES

Equation	Dependent Variable	a	P_t	P_{t-1}	$\left(\frac{P}{IPwh}\right)_t$	$\left(\frac{P}{IPwh}\right)_{t-1}$	t	R^2	F
A 3.02	F_t	3990.7			12.1 (21.7)		-99.2* (41.8)	63.4	6.9
A 3.12	F_t	- 236.6				52.8** (15.2)	-41.9 (33.6)	85.9	21.3
B 3.02	F_t	702.9			42.4 (23.8)		-51.5 (44.5)	72.8	10.7
B 3.12	F_t	-1800.7				65.5** (16.3)	-22.9 (33.2)	88.4	26.7

* Significant at 0.05 level
** Significant at 0.01 level

trawlers operating out of major New England ports was obtained in order to gain insight into the question of whether the annual effort per unit of input is related to landings prices. The vessels operating out of these ports may be looked upon as a representative sample of the New England fishing fleet. Table 8 shows the activity of large and medium trawlers and related variables. One variable, weather conditions during the year, is not represented in the table because of the difficulty of quantifying it in terms of units which are relevant to the trawling operation. This is unfortunate because it may well be one of the more important variables. The basic problem is one of establishing the criteria on which the decision whether to sail or not is based.

Income derived from fishing during the period 1953-57 was considerably below that of the previous years (1947-52). There are two causes: a drop in landings prices and a drop in output per vessel. The (deflated) landings price index moved from an average of 102.6 (for 1947-52) to an average of 92.1 (for 1953-57), a drop of 10.5 percent. The catch per vessel dropped by almost twenty percent. As a consequence vessel owners suffered losses in every year of the second period (see Table 2) and the earnings of the crew were small; the average ratio of fishermen's earnings to annual earnings per employee in the U.S. was .75 during 1953-57.

What is the effect of reduced earnings on the average number

TABLE 8

ACTIVITY OF LARGE AND MEDIUM TRAWLERS[1] AT CERTAIN MASSACHUSETTS PORTS[2] AND RELATED VARIABLES, 1947 - 1957.

Year	Number of Trawlers			Days at Sea		Output[3]	Price of Landings[4]				Unemployment
	Large	Medium	Total	Dl Average per Trawler Large	Dm per Year, per Trawler Medium	Average per Trawler (Thousand Pounds)	P_L (Cents Per Pounds)	$\frac{P_L}{IP_{wh}}$	IP_L (57-59=100)	$\frac{IP_L}{IP_{wh}}$	In New England (Percent)
1947	80	215	295	197	90	648.9	5.85	103.5	82.3	101.4	n.a.
1948	85	212	297	200	103	818.2	6.02	105.7	90.9	103.4	n.a.
1949	81	192	273	194	125	813.1	5.23	90.2	82.2	98.4	8.2
1950	64	181	245	223	117	792.6	6.14	101.6	90.3	104.0	5.2
1951	63	171	234	220	136	707.9	6.65	98.8	101.5	105.0	3.5
1952	69	168	237	208	132	643.0	6.59	100.6	97.1	103.3	3.5
1953	70	162	232	191	121	531.1	6.21	96.2	90.9	98.1	2.9
1954	68	159	227	177	127	595.9	5.75	89.0	86.0	92.6	4.9
1955	57	143	200	194	137	604.8	5.64	86.9	83.6	89.7	3.4
1956	51	148	199	215	133	629.2	5.69	84.9	84.9	88.3	2.7
1957	50	153	203	204	134	593.8	6.44	93.4	91.0	91.9	3.9
Average 1947 - 52:				207	117 (127.5 for 1949 - 52)						
Average 1953 - 57:				197	130.5						

[1]Trawlers are classified as large if 151 gross tons or over; medium if 51 to 150 gross tons.

[2]Boston, Gloucester, New Bedford and Cape Cod.

[3]This average has been calculated on the basis of the whole New England fleet.

[4]See footnotes of Table 2.

Source: E.J. Lynch et al., The Groundfish Industries of New England and Canada: A Comparative Economic Analysis, Fish and Wildlife Service Circular No. 121 (Washington: Department of the Interior, 1961).

See Table 2.

of days at sea per vessel, if any? The answer is little or none at all. Large trawlers were, on the average, 207 days at sea per year during the period 1947-52 and 197 days during 1953-57; a drop of five percent. For the medium-sized trawlers these numbers are 117 and 130 respectively; an increase of eleven percent. Even if the years 1947 and 1948 were eliminated from the latter series on the basis of the assumption that shortly after the war additional days were lost due to more frequent breakdowns of the equipment, there is still an increase. Therefore, if it can be assumed that the quality of the fleet (measured in terms of seaworthiness and reliability) was approximately the same in the years 1949-52 as in 1953-57, it can be stated that the decline in earnings had no clear effect on the annual effort per unit of input.

The relation between the rate of unemployment and the number of days at sea per vessel is presumably positive, because when unemployment is low, some vessels may only fish part of the season due to manning difficulties. But it is difficult to trace this effect. E.g. in 1950 the second year with an unemployment rate of over five percent, large vessels were 223 days at sea which is the greatest number during the period 1947-57. But for medium vessels this number was ten percent below average. And in 1952 when unemployment rates had been down to 3.5 percent for at least one year, the number of days at sea for both sizes of vessels was slightly above average. Naturally it is quite

possible that the effect of this variable was obscured by that of the others.

Returning to the effect of earnings, it should be recognized that for certain purposes averages are sometimes misleading. However, the results of regression analyses confirm our findings. They are found in Table 9 (large trawlers) and Table 10 (medium-sized trawlers). The number of days at sea was related to the landings price per pound and the index of landings prices. None of the parameters was statistically significant. Deflation and introduction of a lag did not alter this fact. Further, some of the parameters have a positive sign, others are negative (the parameters of the lagged variables in Table 9, and the deflated variables in Table 10 have negative signs). Restricting the analysis for medium-sized trawlers to the period 1949-57 gives similar results, as Table 10A shows.

The conclusion is that the New England groundfish fishery provides no evidence of a relation between the number of days at sea and landings prices. These results are consistent with the fact that positively as well as negatively sloped supply curves of inputs have been found; if part of a certain factor of production behaves one way, and the other part in the other, the effects are offsetting and in the aggregate no relation can be observed.

TABLE 9

SUMMARIZED RESULTS OF REGRESSION ANALYSES

Equation	Dependent Variable[1]	a	P_t	P_{t-1}	$\left(\frac{P}{IPwh}\right)_t$	$\left(\frac{P}{IPwh}\right)_{t-1}$	R^2	F
A 4.0	Dl_t	106.38	15.98 (9.07)				25.6	3.1
A 4.1	Dl_t	292.60		-14.97 (10.39)			20.6	2.1
B 4.0	Dl_t	99.00	1.16 (.64)				26.8	3.3
B 4.1	Dl_t	263.86		-.68 (.75)			9.3	.8
A 4.01	Dl_t	133.72			.73 (.68)		11.2	1.1
A 4.11	Dl_t	256.78				-.57 (.74)	6.9	.6
B 4.01	Dl_t	129.77			.74 (.70)		11.1	1.1
B 4.11	Dl_t	228.73				-.26 (.82)	1.2	.1

[1] Dl_t = Average number of days at sea per year, large trawlers.

TABLE 10

SUMMARIZED RESULTS OF REGRESSION ANALYSES

Equation	Dependent Variable[1]	a	P_{L_t}	$P_{L_{t-1}}$	$\left(\frac{P_L}{IPwh}\right)_t$	$\left(\frac{P_L}{IPwh}\right)_{t-1}$	R^2	F
A 5.0	Dm_t	88.31	5.79 (11.13)				2.9	.3
A 5.1	Dm_t	108.28		3.05 (8.44)			1.6	.1
B 5.0	Dm_t	56.10	.75 (.76)				9.7	1.0
B 5.1	Dm_t	88.88		.42 (.56)			6.7	.6
A 5.01	Dm_t	251.78			-1.36 (.63)		33.9	4.6
A 5.11	Dm_t	195.30				-.73 (.49)	21.2	2.2
B 5.01	Dm_t	229.95			-1.09 (.71)		20.7	2.3
B 5.11	Dm_t	186.19				-.61 (.56)	12.6	1.2

[1] Dm_t = Average number of days at sea, per year, medium size trawlers.

TABLE 10A

SUMMARIZED RESULTS OF REGRESSION ANALYSES

Equation	Dependent Variable[1]	a	P_{L_t}	$P_{L_{t-1}}$	$\left(\frac{P_L}{IPwh}\right)_t$	$\left(\frac{P_L}{IPwh}\right)_{t-1}$	R^2	F
A' 5.0	Dm_t	114.52	2.42 (5.35)				2.8	.2
A' 5.1	Dm_t			R^2				
B' 5.0	Dm_t	111.62	.19 (.41)				3.2	.2
B' 5.1	Dm_t			R^2				
A' 5.01	Dm_t	167.19			-.41 (.40)		12.9	1.0
A' 5.11	Dm_t	150.30				-.23 (.41)	4.2	.3
B' 5.01	Dm_t	168.27			-.40 (.38)		13.9	1.1
B' 5.11	Dm_t	167.53				-.39 (.38)	13.1	1.1

[1] Dm_t = Average number of days at sea, medium size vessels.

[2] Variable has been removed: $F < .005$

CHAPTER IV

DEMAND FOR FRESH AND FROZEN GROUNDFISH PRODUCTS IN THE U.S.

In Chapters II and III we studied the nature of the supply in the landings market. The aim of this chapter is to determine the changes in demand in this market and the variables that caused these changes.

The groundfish catch of the U.S. is predominantly sold to the consumer in the form of fillets, fresh as well as frozen. The demand for landings, therefore, is derived from the demand for fillets; changes in the demand for fillets lead to changes in the demand for landings. The aim of this chapter can therefore be achieved by acquiring knowledge of the demand for fillets. But the demand for fillets is affected by what takes place in the whole groundfish market. Hence, as will be demonstrated below, a study of the total demand for groundfish products at the wholesale level is required to single out the variables that affect landings demand.

The basic variables of a demand function are generally agreed upon. They are: the price of the commodity itself, the prices of close substitutes and complementary goods, income and tastes. And apart from tastes, it is not too difficult to quantify these variables. However, with regard to fillets there is a complication; two excellent new substitutes were developed during the period under consideration, namely fish sticks and fish portions. The introduction of these two

new products had an effect on the demand for fillets and will therefore have to be represented in the demand function which is to be estimated.

The following approach is taken to determine the change in the demand for fillets. First the total demand for all fresh and frozen goundfish products will be analyzed and estimates of the parameters of the demand function will be obtained. Shift variables representing the introduction of the new products will be incorporated in this function. The changes in demand for fillets can then be determined by subtracting the actual sales of fish sticks and portions from the increase in total demand which resulted from the introduction of these new products.

The only market level beyond the landings level for which price and quantity data are available for all species is the wholesale market. This market is called the wholesaler-processor market by Farrel and Lampe and a description is found in their paper.[1] In the marketing chain it is the closest one to the landings market. Further, it reflects the effects of product innovation. These two facts explain why an analysis of demand in this market is most useful in answering the question of this chapter. Before turning to the analysis of demand we will briefly review the existing knowledge on this topic and evaluate the model

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[1] Op. cit., pp. 11-13.

that will be used in the analysis.

Review of the Literature

In November of 1968 the Bureau of Commercial Fisheries invited all researchers interested in the demand for fish products to participate in the Demand Workshop Conference in Fisheries. The Inventory of Demand Equations for Fishery Products resulting from this Workshop provides a good indication of what is presently known about the demand for fish products.[2] Most of the equations for groundfish measure the demand for a single species at the landings level. Only one equation dealing with the aggregate of groundfish products was presented. It represents the landings market and is one of the two published by Bell in 1966.[3,4]

Bell's findings are not very helpful. In one equation none of the parameters of the independent variables is statistically significant and the test for auto-correlation is inconclusive at the 0.05 level. In the other equation the parameters of the price index for meat and poultry and personal income are significant, but here the presence of auto-correlation was established.

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[2] D. A. Nash and F. W. Bell, An Inventory of Demand Equations for Fishery Products. Bureau of Commercial Fisheries Working Paper No. 10, (Washington, July 1969).

[3] F. W. Bell, The Economics of the New England Fishing Industry: The Role of Technological Change and Government Aid, Table III-5, 39.

[4] The equation presented to the Workshop contains the parameters of one equation and the values of the other, assuming that Table III-5 is correct. This makes it difficult to determine which of the two equations Bell wished to present.

Auto-correlation can be either attributed to incorrect specification of the form of the relationship or to omitted variables.[5] Bell did not take the shifts in demand, caused by the introduction of the new products into account. This could explain the poor result.

The Model

The model employed in this chapter is the Single-Equation Model or the "Uniequational Complete Model" as Fox calls it in the part of his book which deals with "Modern Econometric Theory and the Single Equation Approach".[6] The statistical technique applied to the single estimating equation to obtain the parameters is the ordinary least squares regression analysis.

R. J. Foote outlines the conditions that have to be met for the single equation model to yield valid estimates of the structural parameters in "Considerations in Choosing a Statistical Procedure for Fitting the Equations When We Wish to Estimate Structural Parameters". He states:

> In many analyses of the demand for agricultural products, factors that cause the demand curve to shift over time are included as separate variables in a multiple regression equation. In effect, we are then able to derive from our estimating equation an average demand curve. This is indicated in a rough way in section F. As discussed on pages 44-49, in some analyses we can assume that the quantity supplied is essentially unaffected by current price.

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[5] See Johnston, op. cit., pp. 177-200.

[6] Karl A. Fox, Econometric Analysis for Public Policy, (Ames Iowa: The Iowa State College Press, 1958), pp. 24-45.

> When price is plotted on the vertical scale, the supply curve in such a case is a vertical line, and year-to-year shifts in supply curve trace out a demand curve, just as they did in section D. Under these circumstances we may be able to obtain valid estimates of the elasticity of demand by use of a least squares multiple regression analysis for which price is the dependent variable and supply and some demand shifters are used as independent variables. This point was noted by Working (107, p. 223), emphasized by Ezekiel in a paper published in 1928 (19) and reconsidered in 1953 by Fox (33) in the light of modern simultaneous equations theory.[7,8,9]

In Chapter III it was demonstrated that the quantity supplied by the domestic industry is not affected by the current price. Does the same apply to the other source of supply, imports? And if the

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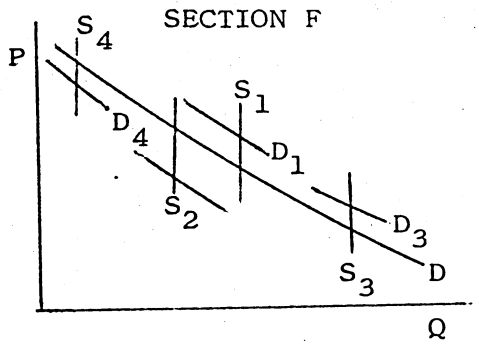
[7] Richard J. Foote, Analytical Tools for Studying Demand and Price Structures, Agriculture Handbook No. 146, (Washington, U.S.D.A., 1958), pp. 53 and 55.

[8] The diagram of Section F has been reproduced below.



[9] The articles referred to are the following:

E.J. Working, "What Do Statistical Demand Curves Show?", in Quarterly Journal of Economics, Vol. XLI, 1927, pp. 212-235, reprinted in American Economics Association Readings in Price Theory; (Chicago: Irwin, 1952), pp. 97-118.

Mordecai Ezekiel, "Statistical Analyses and the Laws of Price", in Quarterly Journal of Economics, Vol. XLII, 1928, pp. 199-225.

Karl A. Fox, The Analysis of Demand for Farm Products, Technical Bulletin 1081, (Washington, 1953).

total supply is predetermined is the apparent consumption also predetermined, i.e. do stocks not absorb a substantial part of the changes in supply? The answer to both questions is in the affirmative; changes in the current price do not, to any great extent, cause changes in imports and stocks. The reason is that frozen fish products have a limited storage life. The optimum storage period for cod fillets has been estimated to be no more than five months while for haddock and ocean perch it is considerably under one year.[10] Thus, to avoid quality deterioration, cod fillets, sticks and portions have to be consumed within five months after the production of the fillet or the block. This five month period applies to a large proportion of imports and stocks because the raw material for most fish blocks, which form a considerable part of the total, is cod fillets. Therefore, foreign processors who are contemplating holding back their supply face not only storage costs, and the problem of financing the increase in stocks, but also the problem of quality deterioration. Assuming that processors could attract funds to finance stock increases (which seems to be a problem for many firms in Canada) the expected price increase would have to be not only in the near future but also a certain minimum magnitude to make it worthwhile. These considerations may have led Bell to his conclusion that imports are not related to the current price.[11]

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[10] See "Frozen Fish Fillets", in Consumer Reports, January 1963, pp. 31, 32.

[11] F. W. Bell, The Economics of the New England Fishing Industry: The Role of Technological Change and Government Aid, p. 38.

The processor in the United States who determines the size of his stocks, faces precisely the same problem. And although stocks have changed somewhat over time, these changes have been relatively small, when compared with the total consumption. The greatest change in stocks took place in 1959 and was 20.5 million pounds, 6.1 percent of the 1959 consumption. But part of the increase in stocks was no doubt due to a higher level of desired stocks resulting from an increased volume of sales. Hence it is reasonable to assume that the apparent consumption is a predetermined variable.

As Foote pointed out, the price variable which is endogenous and therefore correlated with the unexplained residual, should be used as the dependent variable to obtain consistent estimates. However, when the unexplained residuals are small the results are not significantly affected by the choice of the dependent variable.[12] In the following analysis the apparent consumption will be used as the dependent variable because of the desire to measure the effects of the different variables of the demand function in quantity terms. The high R^2's that were obtained in the analyses justify the use of the price variable as an independent variable.

Analysis of Demand in the Wholesale Market

The main seller or supplier in the wholesale market is the processor who purchases the raw material for his product in the

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[12] See e.g. Foote, op. cit., pp. 51-52.

landings market or from importers. In this context the term processor should be interpreted broadly to include the firms that fillet fish, as well as those that transform fish blocks into fish sticks or portions. Besides producing final products the processor also performs a storage function. The processor is faced with the demand of secondary wholesalers and retailers, large institutional buyers and retailers. It is this demand that will be analyzed below. Annual observations for the period 1950-68 form the data. Years prior to 1950 were excluded to avoid possible disturbances in consumption patterns due to war-time and post-war shortages.

Until 1953, groundfish products were sold mainly in the form of fillets, fresh as well as frozen. In the fall of 1953 two new products, fish sticks and fish portions, were introduced to the market. Although they entered the market at virtually the same time, their marketing histories differ widely. These marketing histories have implications for the selection of variables for the demand equations and will, therefore, be briefly reviewed.

Fish sticks were an immediate success; they caught the public's imagination in a matter of months. R. J. Gruber[13] claims that complete market saturation was accomplished in two years, and that this led to overproduction, price cutting and quality deterioration. A similar view was expressed by L. J. Weddig, Executive Director of

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[13] R.J. Gruber, Market Study for the Frozen Fish Trades Association Limited, (St. John's, Newfoundland; July 1966), p.8.

the National Fisheries Institute in Washington. He attributed the stagnation of the stick market in 1955 and 1956 also to poor quality products which, in his opinion, resulted from "the rapid entrance of under-capitalized and marginal firms".[14] It then took a few years for fish sticks to regain the public's favour. This explains why the sales of fish sticks remained at about the same level until 1960.

The story of fish portions is altogether different. Gruber describes it as follows:

> The history of fish portion development in the U.S. differed in many ways from fish sticks. The Blue Water people who pioneered it met with much resistance in the early years. The rectangular shape was widely berated by restaurant people as "2 x 4 fish." The technique of battering and breading took three years to really perfect and this perfection was not generally apparent in the industry as a whole for two or three years later. But by 1959, fully six years after the introduction of the product, its national acceptance was becoming apparent. In the years that followed, raw breaded portions were gradually put on the menus of restaurants, drive-ins, and school lunch. But as late as the beginning of 1964, many large national drive-in chains had not yet accepted them. The capitulation came in mid-1964 when the leading national 15¢ hamburger chain agreed to test market a hot fish sandwich. The results were fantastically successful and by the end of 1964, the 793 units of this chain were all featuring its new hot fish sandwich. Each market was opened with aggressive full-page newspaper ads. During 1965, its first full year, this chain is reported to have sold 70 million hot fish sandwiches. This created terrific excitement in the industry and other die-hards, including all of

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[14] In correspondence with Mr. Weddig.

> the major 15¢ hamburger chains, immediately added hot fish sandwiches backed by impressive newspaper advertising.
>
> By mid-1965 it was clear that national market saturation had been completed on raw breaded fish portions in the food service industry. Thus, it took fish portions twelve years to accomplish what fish sticks did in two years.[15]

As was pointed out in the introduction to this chapter, the wholesale market is the only one for which data are available on the prices and quantities of all species. The quantities of each product were estimated by adding imports to the domestic landings (fillet weight) and adjusting the total for changes in stocks. The calculations for fillets, blocks, sticks and portions are found in tables B-1 to B-3 of Appendix I. Table 11 presents a summary. A further breakdown of the total for fillets into species, distinguishing between fresh and frozen, is found in tables B-4 to B-8 of Appendix I.

Two overall totals were constructed: fillets and blocks; and fillets, sticks and portions. From the consumer's point of view fillets and blocks are altogether different products; fillets are a final product, whereas blocks are a raw material. Fillets and sticks and portions appear at the same level of the marketing chain, and the buyers and sellers of these products have been described above. For blocks it should be noted that the processor is the buyer and the importer is the seller.

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[15] Op. cit., p. 9.

TABLE 11

APPARENT CONSUMPTION OF FRESH AND FROZEN GROUNDFISH FILLETS, BLOCKS, STICKS, AND PORTIONS.
(Totals in Million Pounds)

Year	Fillets		Blocks		Sticks and Portions		Fillets and Blocks		Fillets, Sticks and Portions	
	Total	Per Capita	Total	Per Capita	Total	Per Capita	Total	Per Capita	Total	Per Capita
	(1)	(2)	(3)	(4)	(5)	(6)	(1)+(3)	(2)+(4)	(1)+(5)	(2)+(6)
1950	239.7	1.578					239.7	1.578	239.7	1.578
1951	282.3	1.833					282.3	1.833	282.3	1.833
1952	269.1	1.721					269.1	1.721	269.1	1.721
1953	256.9	1.616	n.a.[1]	n.a.[1]	n.a.[1]	n.a.[1]	256.9	1.616	256.9	1.616
1954	251.9	1.556	40.0	.247	47.0	.290	291.9	1.803	298.9	1.846
1955	240.1	1.454	53.9	.326	60.0	.363	294.0	1.781	300.1	1.818
1956	242.8	1.444	43.1	.256	53.2	.316	285.9	1.701	296.0	1.761
1957	259.6	1.516	53.8	.314	63.0	.368	313.4	1.831	322.6	1.884
1958	252.8	1.452	71.8	.412	81.9	.470	324.6	1.865	334.7	1.923
1959	239.0	1.350	78.8	.445	96.8	.547	317.8	1.795	335.8	1.896
1960	233.0	1.295	88.8	.493	112.5	.625	321.8	1.787	345.5	1.920
1961	241.4	1.318	126.9	.693	128.8	.703	368.3	2.011	370.2	2.022
1962	250.3	1.346	138.5	.745	150.1	.807	388.8	2.091	400.4	2.154
1963	244.5	1.296	153.8	.815	172.3	.913	398.3	2.111	416.8	2.209
1964	249.7	1.305	174.0	.909	185.6	.970	423.7	2.214	435.3	2.274
1965	261.1	1.347	200.3	1.034	217.1	1.120	461.4	2.381	478.2	2.468
1966	267.5	1.366	214.8	1.097	224.1	1.144	482.3	2.462	491.6	2.510
1967	254.6	1.286	198.6	1.004	238.1	1.203	453.2	2.290	492.7	2.490
1968	279.5	1.398	252.6	1.263	261.6	1.313	532.1	2.660	541.1	2.705

[1]Included with fillets.

Source: Tables B-1, B-2 and B-3 of Appendix I.

Processors of fillets not only report holdings of stocks and production on a per species basis (see Tables A-1 and A-4), but also the value of their product. This makes it possible to calculate an average annual price per pound for each species. These prices are found in Table A-5. With the aid of these prices, the price indexes found in Table 12 were constructed. Because of the change in the composition of the totals, the link relative method had to be used. For the various products the period 1950-68 was divided into shorter periods. The shorter periods were chosen in such a way that the product-mix did not change substantially during the period. A weighted price index was constructed for each period, using the average annual quantities as weights. Overlapping years provided the links between periods.[16]

We will now turn to the demand equations that were estimated. The variables which influence the demand of most commodities in the United States are found in Table 13. In order to reduce the number of variables of the equation, per capita quantities were used instead of total quantities. For the same reason the prices of groundfish products and their substitutes, meat and poultry, were deflated by the Wholesale Price Index in one analysis and by the Consumer Price Index in the other (see Table 14). Further, Per Capita Personal Disposable Income in real terms (1958 dollars) was included to reflect the increase in purchasing power in the economy. Logarithmic equations were used because the relationship

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[16]For a more detailed explanation of "linking" see e.g. S. B. Richmond, Statistical Analysis, 2nd. ed., (New York: The Ronald Press Co., 1964), pp. 494-95.

TABLE 12

INDEXES OF GROUNDFISH PRICES RECEIVED BY U.S. PROCESSORS
(Current Dollar Prices, 1957-59=100)

Year	Fillets		Blocks	Sticks	Portions	Fillets Fresh & Frozen	Fillets and Blocks	Fillets, Sticks and Portions
	Fresh	Frozen					Pfb	Pfsp
1950	84.7	95.8				92.7	95.4	101.0
1951	93.7	102.2				99.8	102.7	108.0
1952	95.6	101.3				99.6	102.6	108.6
1953	91.1	98.4	n.a.	n.a.	n.a.	96.4	99.2	105.0
1954	86.1	91.0	103.9	116.9	n.a.	89.6	92.3	97.7
1955	88.0	92.0	103.0	101.0	n.a.	90.9	93.2	94.0
1956	90.5	92.1	98.8	96.8	n.a.	91.7	93.3	93.4
1957	94.7	91.4	100.6	97.7	n.a.	92.3	94.1	94.1
1958	103.1	106.3	101.6	97.7	101.7	105.4	104.6	103.2
1959	102.2	102.3	97.8	104.6	98.3	102.3	101.3	102.7
1960	102.9	101.6	100.6	97.1	98.6	101.9	101.6	100.5
1961	100.9	102.5	101.6	95.1	103.1	101.8	101.8	101.2
1962	100.7	106.2	96.9	91.8	99.2	104.1	101.9	100.4
1963	101.7	108.2	100.2	87.8	99.4	105.7	104.1	100.3
1964	100.9	109.0	108.5	90.0	95.6	105.8	106.8	100.1
1965	111.7	119.1	118.3	95.7	110.8	116.2	116.9	111.2
1966	121.4	126.6	121.1	97.1	109.2	125.1	123.4	114.8
1967	124.5	122.8	111.3	97.3	100.8	123.3	118.4	111.2
1968	130.5	126.2	105.3	99.7	104.4	127.6	118.6	114.9

Source: Computed from Table A-5.

TABLE 13

VARIABLES AFFECTING DEMAND IN THE UNITED STATES

Year	Total Resident Population (Millions)	Pers. Disp. Income per Capita		Price Index for all Items (1957-59=100)	
		Current $$	1958 $$	Wholesale	Retail
			Y	Pwh	C.P.I.
1950	151.9	1,364	1,646	86.8	83.8
1951	154.0	1,469	1.657	96.7	90.5
1952	156.4	1,518	1,678	94.0	92.5
1953	159.0	1,583	1,726	92.7	93.2
1954	161.9	1,585	1,714	92.9	93.6
1955	165.1	1,666	1,795	93.2	93.3
1956	168.1	1,743	1,839	96.2	94.7
1957	171.2	1,801	1,844	99.0	98.0
1958	174.1	1,831	1,831	100.4	100.7
1959	177.1	1,905	1,881	100.6	101.5
1960	180.0	1,937	1,883	100.7	103.1
1961	183.1	1,983	1,909	100.3	104.2
1962	185.9	2,064	1,968	100.6	103.1
1963	188.7	2,136	2,013	100.3	106.7
1964	191.4	2,272	2,116	100.5	108.1
1965	193.8	2,411	2,214	102.5	109.9
1966	195.9	2,597	2,321	105.9	113.1
1967	197.9	2,744	2,401	106.1	116.3
1968	200.0	2,928	2,473	108.7	121.2

Source: Department of Commerce, Bureau of the Census, Statistical Abstract of the United States, 1951-69.

Department of Commerce, Office of Business Economics, Survey of Current Business, June 1969.

TABLE 14.

PRICE VARIABLES AFFECTING DEMAND FOR GROUNDFISH PRODUCTS IN THE UNITED STATES
(Ratio's of Index Numbers)

Year	Pfb/Pwh	Pfb/CPI	Pfb/Pm&p	Pfsp/Pwh	Pfsp/CPI	Pfsp/Pm&p	Pm/Pwh	Pp/Pwh	Pm&p/Pwh	Pm/CPI	Pp/CPI	Pm&p/CPI
1950	109.9	113.8	86.3	116.4	120.5	91.4	119.3	171.1	127.3	123.6	177.2	131.9
1951	106.2	113.5	80.7	112.5	120.2	85.5	124.3	169.1	131.6	132.8	180.7	140.7
1952	109.2	110.9	87.6	115.6	117.4	92.7	117.9	159.4	124.6	119.8	161.9	126.6
1953	107.0	106.4	98.4	113.3	112.7	104.2	100.3	156.0	108.8	99.8	155.2	108.2
1954	99.3	98.6	95.3	105.1	104.4	100.8	99.4	130.6	104.3	98.7	129.7	103.5
1955	100.0	99.9	103.8	100.9	100.7	104.7	89.6	137.8	96.4	89.5	137.6	96.2
1956	97.0	98.5	110.8	97.1	98.6	110.9	83.0	112.7	87.6	84.3	114.5	88.9
1957	94.9	96.0	100.6	94.9	96.0	100.6	92.6	102.3	94.3	93.8	103.6	95.4
1958	105.2	103.9	97.1	103.8	102.5	95.8	109.6	102.8	108.2	108.2	101.5	107.0
1959	101.7	99.8	102.6	103.1	101.2	104.1	99.6	96.7	99.1	97.7	94.9	97.2
1960	101.9	98.5	104.4	100.8	97.5	103.3	97.1	100.2	97.6	93.9	96.9	94.4
1961	102.5	97.7	109.1	101.9	97.1	108.5	95.8	86.4	94.0	91.3	82.3	89.5
1962	102.3	98.9	105.7	100.8	97.4	104.1	98.2	90.6	96.8	94.9	97.5	93.5
1963	104.8	97.6	114.4	101.0	94.0	110.2	92.2	89.3	91.7	85.8	83.0	85.3
1964	107.3	98.8	118.0	100.6	92.6	110.6	89.5	97.9	91.0	82.3	90.1	83.7
1965	114.1	106.4	118.2	108.5	101.2	112.4	98.4	88.7	96.5	91.7	82.7	90.0
1966	116.5	109.1	115.0	108.4	101.5	107.0	103.7	91.9	101.3	97.2	86.0	94.9
1967	111.7	101.8	116.9	104.7	95.6	109.8	99.4	81.1	95.5	90.6	73.9	87.1
1968	109.1	97.9	113.8	105.7	94.8	110.3	99.1	84.4	95.9	88.9	75.1	86.0

Source: Computed from tables 12 and 13.

was assumed to be multiplicative rather than additive.

The above variables, the price (or quantity) of the product under consideration, the price of its main substitute, income, population, and a measure of the general price level are the ones one expects to find in most demand equations. The parameters of equations with these variables were estimated. The results: none of the parameters was statistically significant. This could be interpreted in various ways; the validity of the general theory of demand could be questioned, fish products could be labelled as an exception, or an error could have been made. The last possibility was further considered.

The analysis so far had not taken into account the new products that were introduced during the period. This was clearly the error that had been made. As Gruber's description of the marketing history of portions clearly illustrates, new markets were opened and the overall demand increased. In the analyses referred to above, part of this increase could be attributed to increases in income (leading to a biased parameter for income), but then another variable would have to explain why these increases did not take place in the early 1950's when income increased also. The conclusion is, in short: significant results cannot be expected when one significant variable has been omitted.

The problem was solved by the inclusion of two additional variables. The introduction of fish sticks raised the total

demand to a new level at which it stayed for a number of years. A dummy variable, zero for 1950-53 and one for 1954-68, could capture this.[17] The sales of portions showed a different picture, it continued to increase after 1958 (when national acceptance had been achieved), because of 1) advertising aimed at institutions and 2) additional sales through new outlets such as restaurants, drive-in chains, and hamburger chains. A trend variable starting in 1958 is required to reflect these developments.

The following equations were used in the regression analyses:

$$Qfb = \alpha_1 + \beta_1 \frac{Pfb}{Pwh} + \beta_3 \frac{Pm}{Pwh} + \beta_4 \frac{Pp}{Pwh} + \beta_6 Y + \beta_7 D_1 + \beta_8 D_2 t$$

$$Qfb = \alpha_2 + \beta_1 \frac{Pfb}{Pwh} + \beta_5 \frac{Pm\&p}{Pwh} + \beta_6 Y + \beta_7 D_1 + \beta_8 D_2 t$$

and

$$Qfb = \alpha_3 + \beta_2 \frac{Pfb}{Pm\&p} + \beta_6 Y + \beta_7 D_1 + \beta_8 D_2 t$$

where Qfb = apparent per capita consumption of fillets and blocks

Pfb = wholesale price index of fillets and blocks

Pm = wholesale price index of meat

Pp = wholesale price index of poultry

Pm&p= wholesale price index of meat and poultry

Pwh = wholesale price index of all items

Y = annual per capita disposable income in 1958 dollars

D_1 = dummy variable, zero for 1950-53 and one for 1954-68

$D_2 t$ = trend variable starting in 1958; t = 1 for 1958

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[17] Econometric research in recent years provides many examples of the use of dummy variables in regression analysis. For a description and evaluation of this technique see e.g. J. Johnston, Econometric Methods, (Toronto: McGraw-Hill Book Co., 1963), pp. 221-228.

When Qfb and Pfb are replaced by Qfsp (the apparent per capita consumption of fillets, sticks and portions) and Pfsp (the price index of fillets, sticks and portions) respectively, the equations for estimating the demand for fillets, sticks and portions are obtained.

The results of the analyses are found in Tables 15 and 16. The signs of the parameters are all as predicted by economic theory and the magnitudes of those that appear in all three equations are similar. Table 16 shows that deflation of all prices by the Consumer Price Index does not affect the results to any great extent. The only difference is that smaller parameters for the prices of groundfish products are obtained when these prices are deflated by the Consumer Price Index.

The best results in terms of the level of significance of parameters and the value of R^2 were obtained with the use of the ratio of the price of groundfish products over the price of meat and poultry. For fillets and blocks (equation 6.3, Table 15) the parameter of this ratio is almost significant at the 0.05 level and the trend variable is clearly statistically significant at this level. Of the total fluctuation in the apparent per capita consumption, 90.6 percent is explained by the four variables of the equation. The Durbin-Watson statistic of 1.89 indicates that there is no auto-correlation.

The equation for fillets, sticks and portions (equation 7.3)

TABLE 15

SUMMARISED RESULTS OF REGRESSION ANALYSES

Equation	a	$\frac{Pfb}{Pwh}$	$\frac{Pfb}{Pm\&p}$	$\frac{Pfsp}{Pwh}$	$\frac{Pfsp}{Pm\&p}$	$\frac{Pm}{Pwh}$	$\frac{Pp}{Pwh}$	$\frac{Pm\&p}{Pwh}$	Y	D_1	D_2t	$\bar{R}^2$	F	D-W
6.1[1]	-.62	-.45 (.49)				.32 (.19)	.16 (.14)		.23 (.40)	.046 (.031)	.016* (.006)	89.3	16.7	1.98
6.2[1]	-.68	-.40 (.47)						.41 (.23)	.26 (.39)	.036 (.025)	.014* (.005)	89.9	23.0	1.89
6.3[1]	-.65		-.41 (.22)						.26 (.37)	.035 (.019)	.014* (.005)	90.6	33.6	1.89
7.1[2]	-.45			-.57 (.39)		.37* (.15)	.14 (.10)		.24 (.28)	.046 (.023)	.014** (.004)	95.0	38.4	1.97
7.2[2]	-.54			-.51 (.36)				.46* (.18)	.27 (.27)	.040 (.020)	.013** (.003)	95.4	53.4	1.83
7.3[2]	-.61				-.46* (.17)				.25 (.26)	.044** (.012)	.013** (.003)	95.7	77.8	1.83

[1] Dependent Variable is Qfb

[2] Dependent Variable is Qfsp

* Significant at 0.05 level
** Significant at 0.01 level

TABLE 16

SUMMARISED RESULTS OF REGRESSION ANALYSES

Equation	a	$\frac{Pfb}{CPI}$	$\frac{Pfsp}{CPI}$	$\frac{Pm}{CPI}$	$\frac{Pp}{CPI}$	$\frac{Pm\&p}{CPI}$	Y	D_1	D_2t	$\bar{R}^2$	F	D-W
8.1[1]	-.30	-.30		.29	.15		.21	.052	.016	89.4	16.9	1.99
		(.51)		(.21)	(.14)		(.41)	(.031)	(.006)			
8.2[1]	-.82	-.24				.38	.23	.041	.014*	89.9	23.2	1.91
		(.49)				(.24)	(.40)	(.025)	(.005)			
9.1[2]	-.59		-.45	.35	.13		.22	.051*	.015**	95.0	38.3	1.94
			(.45)	(.17)	(.11)		(.29)	(.024)	(.004)			
9.2[2]	-.67		-.39			.43*	.24	.046*	.013*			
			(.41)			(.20)	(.27)	(.021)	(.004)	95.3	53.1	1.82

[1]Dependent variable is Qfb

[2]Dependent variable is Qfsp

*Significant at 0.05 level
**Significant at 0.01 level

is the most satisfactory one when the criteria stated above are applied. All parameters except the one of Y are significant (two at the 0.01 level). The four variables explain 95.7 percent of the variation in the per capita consumption. And the Durbin-Watson statistic of 1.83 indicates that there is no auto-correlation. This equation has been adopted as the one which gives the most accurate picture of the forces at work in the demand side of the wholesale market for groundfish products. The implications for the demand in the landings market will be outlined in the following chapter.

CHAPTER V

THE EFFECTS OF IMPORTS ON UNITED STATES GROUNDFISH PRICES

This chapter analyzes the drop in the Atlantic Coast landings prices in the 1950's. The aim is to estimate the effect of increased imports on these landings prices.

The Atlantic Coast is the major region in the United States groundfish fishery; it accounts for approximately eighty percent of all U.S. groundfish landings. All imports come from either Canada or certain European countries, enter the United States on the East Coast and move through the same markets as the domestic product. Of the twenty percent landed on the Pacific Coast, only a small portion is used for the production of frozen fillets.[1,2] Therefore the effects of increased imports are primarily felt by the Atlantic Coast fishery. It is for this reason that data for the Pacific Coast have not been included in the analysis and that no distinction is made between the Atlantic Coast and the total groundfish fishery of the United States.

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[1] See: Bureau of Commercial Fisheries, Frozen Fishery Products Annual Summary, for the various years.

[2] The need to distinguish between the market for fresh and the market for frozen products was stressed by Vincent Dunfey as well as F. W. Bell.

See: F. W. Bell and J. E. Hazleton (eds.), Recent Developments and Research in Fisheries Economics, pp. 61-63.

F. W. Bell, The Economics of the New England Fishing Industry: The Role of Technical Change and Government Aid, p. 33.

Imports of groundfish products increased sharply in 1954, due to the imports of fish blocks. The reason for this was the development and production on a large scale of fish sticks for which fish blocks are the main raw material. Fish sticks were introduced to the U.S. market in 1953 (total production 7.5 million pounds) but it was not until 1954 that they had a noticeable impact on the market. In 1954, fifty million pounds of fish sticks were produced and for the next six years the annual production fluctuated between fifty and sixty-five million pounds. (See Table B-3, Appendix I).

The first problem is to estimate the magnitude of the drop in landings prices in the 1950's. One approach is to compare the average price index for the period 1947-52 (before the price drop) with that of 1953-57 (the period with low prices). A second approach makes use of a so-called dummy variable to estimate the drop in landings prices. This technique has also been used in a recently published study carried out by the U.S. Bureau of Commercial Fisheries, which bears the same title as this chapter.[3]

The second problem of this chapter is to determine which factors caused landings prices to drop and the relative importance of each of them. Since the landings market is reasonably competitive, the explanation for changes in prices can be found in the reasons

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[3]Department of the Interior. Report of the Secretary of the Interior to the President and the Congress on The Effects of Imports on the United States Groundfish Industry, pp. 53-55.

for the changes in supply and demand.[4] Therefore, to answer the question why landings prices have declined, the changes in supply and demand and the reasons for these changes will have to be determined. No parallels can be drawn between this analysis and the study of the Bureau of Commercial Fisheries because an analysis of supply and demand in the landings market has not been carried out by the Bureau.

Landings Prices of Groundfish, Atlantic Coast of the U.S.

Table 17 shows the landings prices for individual groundfish species (columns 1 to 5), a weighted average price (columns 6 and 7), and a price index for groundfish (column 8). In column 9 the price index has been divided by the wholesale price index for all items, in order to obtain a measure of landings prices in real terms.

It should be noted that the weighted average price does not provide an accurate measure of the changes in landings prices, because of changes in the composition of the landings (see Table 18). E.g. the landings of ocean perch, a low priced species, declined strongly after 1954; landings in 1967 were about one-third of the average for 1947-54. And the landings of flounder, a high

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[4]There are many suppliers in the landings market. The typical firm in the groundfish fishery is the single boat-unit with the owner and the crew sharing in the proceeds and in the costs of the trip. And in each of the main ports (Boston, Gloucester and New Bedford) there are more than ten buyers.

See: Farrell and Lampe, op. cit. pp. 6,7.

TABLE 17

LANDINGS PRICES[1] OF GROUNDFISH, ATLANTIC COAST (U.S.), 1947-67.

(Cents Per Pound)

Year	Cod (1)	Haddock (2)	Cusk, Hake & Pollock (3)	Ocean Perch (4)	Flounder (5)	Average Price[2] (6)	Average Price[2] (57-59=100) (7)	I_{PL}[3] (57-59=100) (8)	$\frac{I_{PL}}{I_{PWh}}$[4] (9)
1947	5.93	6.93	3.33	4.04	9.61	6.08	83.4	83.1	102.3
1948	6.65	7.96	3.61	4.05	10.93	6.27	86.0	91.5	104.1
1949	5.98	6.85	2.13	4.14	10.38	5.50	75.4	83.3	99.8
1950	6.30	7.46	3.32	4.40	11.27	6.40	87.8	91.1	105.0
1951	7.27	7.77	4.22	4.88	13.53	6.90	94.6	102.2	105.7
1952	7.23	7.74	3.92	4.34	13.65	6.90	94.6	98.9	105.2
1953	6.76	7.54	3.48	3.88	12.70	6.56	89.9	92.4	99.7
1954	5.93	6.51	3.37	4.06	12.44	6.09	83.5	87.3	94.0
1955	6.06	6.00	3.14	3.85	12.77	5.95	81.6	84.9	91.1
1956	6.33	6.30	2.97	3.79	12.60	5.98	82.0	85.6	89.0
1957	6.39	7.63	3.66	3.80	12.51	6.77	92.8	91.9	92.8
1958	7.35	9.81	4.16	4.22	12.13	7.49	102.7	103.9	103.5
1959	7.13	9.71	3.88	4.14	12.89	7.62	104.5	104.2	103.6
1960	6.68	7.92	3.14	3.83	12.43	6.71	92.0	92.8	92.2
1961	6.43	7.42	3.32	3.87	11.15	6.62	90.8	87.7	87.4
1962	7.02	8.13	3.60	4.21	10.43	7.15	98.0	89.6	89.0
1963	7.36	9.44	3.86	4.75	9.33	7.64	104.8	92.6	92.3
1964	6.89	8.87	4.72	4.24	9.00	7.49	102.7	87.9	87.4
1965	7.98	10.18	5.56	4.06	10.88	8.72	119.6	100.8	98.3
1966	8.52	10.54	5.43	4.20	12.84	9.57	131.2	110.1	104.0
1967	8.06	11.27	5.51	3.92	12.14	9.37	128.5	109.1	102.8

[1] Also frequently referred to as ex-vessel prices.

[2] Obtained by dividing the total value of groundfish landings by the total quantity.

[3] Index of landings prices. Constant weights (average quantities) were used in constructing this index.

[4] Index of landings prices deflated by the wholesale price index for all items.

Source: Bureau of Commercial Fisheries, Fishery Statistics of the U.S., 1947-67.

TABLE 18

LANDINGS OF GROUNDFISH, ATLANTIC COAST (U.S.), 1947-67

(Millions of Pounds)

Year	Cod	Haddock	Cusk Hake and Pollock	Ocean Perch	Flounder	Total
1947	66.9	166.4	48.6	146.6	84.7	513.2
1948	71.3	156.4	63.9	238.1	87.1	616.9
1949	62.2	135.0	89.3	237.0	83.5	607.4
1950	57.5	158.6	47.0	207.8	81.9	552.7
1951	50.0	154.1	44.0	258.3	73.2	579.7
1952	43.7	161.5	47.0	189.0	70.2	511.4
1953	32.6	139.6	40.1	153.9	63.5	429.2
1954	36.8	154.9	33.8	181.5	64.1	471.3
1955	35.6	135.0	40.7	157.0	63.4	431.8
1956	35.1	152.2	42.0	151.1	65.1	445.6
1957	34.1	133.6	33.8	133.9	69.3	404.6
1958	41.4	119.6	44.5	148.6	77.3	431.4
1959	46.5	112.6	36.9	136.7	75.0	407.7
1960	40.4	118.7	39.0	141.4	79.4	418.9
1961	46.6	133.6	37.2	132.1	85.4	434.9
1962	46.9	134.2	30.6	124.0	104.5	439.2
1963	42.2	124.0	29.5	108.3	125.5	429.4
1964	38.7	133.5	23.8	89.3	129.0	414.3
1965	36.0	133.9	21.2	83.6	133.7	408.5
1966	37.5	132.3	16.9	81.6	127.7	396.0
1967	44.4	98.5	13.3	71.4	112.5	340.0

Source: Bureau of Commercial Fisheries, Fishery Statistics of the U.S. 1947-67.

prices species, increased considerably in the 1960's. The effect of both these changes in the composition of landings is to increase the average price of landings. In order to avoid this bias, an index of landings prices was constructed, using the link relative method. This method has been widely used to cover the transition between periods of different product-mixes or market baskets. The period 1947-67 was divided into three periods which overlapped by one year. The periods were chosen in such a manner that the quantities landed of each species did not change substantially in each of them. A weighted price index was constructed for each period. The average annual quantities landed of the various species were used as weights. The overlapping years provided the links between the three periods.[5] The result is found in column 8 of Table 17.

A comparison between the index of landings prices (column 8) and the index of the average landings prices (column 7), shows the upward bias of the latter. Up to 1961 the changes in the two indexes are comparable, but after this year the numbers in column 7 increase much more rapidly than those in column 8. In the analysis which follows we will, therefore, make use of the index of landings prices rather than the average landings prices.

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[5]The price index was constructed in the same way as the one found in Chapter IV.

Little change took place in the average nominal price, when the two periods 1947-52 and 1953-57 were compared. The average of the index numbers for the first period is 91.7 and for the second 88.4. However, the drop in real landings prices is greater since the wholesale prices of most items did rise during the period 1947-57. The average of the index numbers representing real landings prices dropped from 103.7 for 1947-52 to 93.3 for 1953-57; a decline of ten percent.

The other approach to measuring the drop in landings prices is to apply to the data a regression analysis in which one of the independent variables is a dummy variable. In this regression analysis landings prices are related to a time variable "t" (1947=1), to capture the trend feature. The second independent variable is the dummy variable "D" which is used to capture the shift in relationship between landings prices and the time variable. The dummy variable is equal to zero for the years 1947 to 1952, and is equal to one for 1953 to 1967.

The parameters of the following equations were estimated:

$$IP_L = \alpha + \beta_1 t + \beta_2 D$$

$$\frac{IP_L}{IPwh} = \alpha + \beta_1 t + \beta_2 D$$

$$\frac{IP_L}{IPwh} = \alpha + \beta_2 D$$

The results are found in Table 19. Equation 10.1 shows that for nominal landings prices, the trend variable is statistically significant; the increase per year is 1.21 index points. The drop in landings prices is 9.63 points which is 10.5 percent when related to the average of the index for 1947-52. But this parameter is not statistically significant.

From equation 11.1 it is clear that real landings prices have no trend. When the time variable is included in the equation the magnitude of the decline is 11.26 index points (10.9 percent). But without this statistically nonsignificant variable the decline is 8.54 index points which is 8.2 percent (equation 11.2). The parameter of the dummy variable which indicates the magnitude of the shift (the decline in landings prices in this case) is statistically significant in both equations.

The results of our analyses are substantially different from those found in the report of the Bureau of Commercial Fisheries, as will be demonstrated below.[6] The result of the regression analysis of the Bureau has been included in Table 19 for ease of comparison.

A guess had to be made as to how the Bureau obtained the landings price series (referred to as ex vessel price in the Report), and what is precisely included in it. Nowhere in the

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[6] Op. cit., pp. 53-55.

TABLE 19

SUMMARIZED RESULTS OF REGRESSION ANALYSES

Equation	Dependent Variable	a	t	D	R^2	F
10.1	IP_L	87.46	1.21* (.41)	-9.63 (5.52)	34.2	4.7
11.1	$\frac{IP_L}{IPwh}$	102.78	.26 (.32)	-11.26* (4.30)	37.7	5.4
11.2	$\frac{IP_L}{IPwh}$	103.68		-8.54* (2.65)	35.4	10.4
Bureau of Commercial Fisheries	Price	5.09	.18 (.025)	-1.6	n.a.	n.a.
12.1	P_L	5.58	.22** (.03)	-1.31* (.44)	76.1	28.8

* Significant at 0.05 level
** Significant at 0.01 level

Report is a description of the time series given. The only place where those data are presented is in Figure 13 on page 55, and the source is not given.[7] From the magnitude of the prices it seems that an average (undeflated?) landings price was used. From a previous table (no.17, p.50) in which landings prices for individual species are given for the Atlantic as well as the Pacific Coast, one gains the impression that the landings price used in the regression analysis represents all U.S. groundfish. This would mean that the data used by the Bureau are not identical to those of this study. However, since the Atlantic Coast landings are around 80 percent of the U.S. total, the landings prices may be expected to be similar.

Nominal landings prices show a trend as was pointed out above. The trendline is steeper for average landings prices than for their price index because of the upward bias of the former in the 1960's. This is illustrated by the equation of the Bureau. The parameter of "t" is .18 (cents) which, when related to the average 1947-52 price, represents an annual increase of landings prices of 3.15 percent. This is to be compared with an annual increase of 1.21 index points or 1.3 percent for the index of landings prices.

The effect of the bias in the dependent variable is noticed

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[7]Figure 13 has been reproduced in Appendix II, Table C-1.

equally clearly when the parameters of the dummy variables are compared. Elementary geometry would indicate that the vertical distance between two parallel (trend) lines (which measures the price drop) increases when each of them rotates around a certain point so as to increase its slope. The only condition is that the pivotal point of the lower line is to the right of that of the upper. This condition has been met in the case under consideration; the pivotal point of the lower line falls in the period 1953-67 and that of the other line in 1947-52.

The results of the regression analyses reflect the above prediction. According to the equation of the Bureau the drop in landings prices is 1.6 cents, which is 28 percent. But equation 10.1 presents a figure of 9.63 index points which is 10.5 percent and when the index of real landings prices is used the decline is estimated to be 8.54 points or 8.2 percent (equation 11.2, Table 19).

One regression analysis was carried out in this study, using the average landings price as the dependent variable, to see if the parameters would be similar to those obtained by the Bureau. To avoid possible misunderstanding it should perhaps be noted that the purpose of this analysis was to compare parameters. Its purpose was <u>not</u> to obtain an alternative estimate of the decline in landings prices.

The parameter of the trend variable of equation 12.1 is .22 which represents an annual price increase of 3.47 percent, which

is close to the 3.15 percent of the Bureau. But the parameters of the dummy variable show a greater difference. According to the Bureau the price drop is 1.6 cents, which is 28.0 percent, while according to equation 12.1 it is 1.31 cents or 20.7 percent. Even though the data are not identical, as has been pointed out, this is a greater difference than one would expect, and merits further investigation.

A comparison (see Appendix II) between the average price of Atlantic Coast landings and the one used by the Bureau shows that with the exception of 1949, for every year of the period 1947-67 the former is at least .6 cents higher than the latter. In 1949 the average for the Atlantic Coast is .4 cents lower than the price used by the Bureau. A double check has been made against the source (Fishery Statistics of the U.S.) to ensure that no computational error has been made. Although it cannot be established with certainty for reasons which have already been pointed out, the comparison of the two series casts doubt on the Bureau's 1949 landings price. It seems, therefore, likely that an error in the calculation of the 1949 price is responsible for at least a large portion of the difference between the two estimates of the decline in landings prices.

Supply to the Landings Market

The question of the changes in the supply in the 1950's and its effects on landings prices is not a difficult one to answer. In Chapter III it was demonstrated that the quantity supplied in the short run is not related to price. This means that if the changes in the quantities supplied and the elasticity of demand were known (which is the case) the changes in prices could be calculated.

Table 18 shows the annual quantities of the various species supplied to the landings market. The difference between the average annual landings for 1947-52 and 1953-57 for each species provides a measure of the changes in supply. When these differences are related to the averages for 1947-52, the percentage change in the quantity supplied of each species can be calculated.

F. W. Bell has estimated the effects of changes in the quantity supplied on landings prices for different groundfish species.[8] The only species that Bell's study did not cover are cusk, hake and pollock. Judging from the landings prices the consumer ranks these species among ocean perch and cod. To avoid an underestimate, the parameter for cod (the larger of the two) has been applied to cusk, hake and pollock.

The percentage changes in the landings prices of each species

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[8] F. W. Bell, "The Pope and the Price of Fish", Table 1.

were obtained by multiplying the percentage changes in landings with the parameters (of the quantity variable) estimated by Bell. Relating these percentages to the average prices for 1947-52 yielded the changes in prices in absolute terms. When these changes were introduced in the price index the result was a difference of 5.6 points. This means that if the quantities supplied had not declined during 1953-57, the price index would have been 5.6 points lower, which represents a drop in landings prices of 6.1 percent.

Demand in the Landings Market

Until 1953 groundfish was predominantly sold in the form of fillets; fresh as well as frozen.[9] Only small quantities were sold as "round" fish. In 1953, with the development of fish sticks, some of the exporting countries started to sell part of their product in the form of fish blocks. But American processors did not produce large quantities of blocks, because of the relatively low price of this product. American landings continued to be processed into fillets. With declining landings and a growing demand, an increasing proportion of the fillets were sold in the fresh fish market where prices tend to be higher.

Demand in the landings market is exercised by processors who wish to supply fillets to wholesalers or retailers. Their demand

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[9]The only exception to this is ocean perch, which is almost exclusively sold in the form of frozen fillets.

is derived from the demand of the latter. In turn the demand of wholesalers and retailers depends on the demand of the consumers.

The demand at the wholesale level is satisfied by two sources of supply: domestic landings which are transformed into fillets by processors, and imports. Any changes in the demand in the domestic landings market have to be attributed to changes in the demand for fresh and frozen fillets at the wholesale level and the extent to which this demand is satisfied by imports. We will first determine which changes in imports of fillets, if any, took place after 1953.

Table 4 shows imports of fresh and frozen fillets as a percentage of total consumption. In 1951 imports were 32.4 percent and from 1952 to 1965 ranged between 35 and 46 percent of total consumption. Although no data were obtained for the late 1940's, one may expect that after the war it took a number of years for trade patterns to become established. As Table 20 shows, it was not until 1952 that imports approached the level at which they would remain for thirteen years.

Did the imports of fillets change in 1954 and the years following when large quantities of fish sticks were sold? The answer naturally depends on the standard of comparison. If the years immediately prior to 1954 are taken as a standard, there is little or no change. The average percentage imported during 1952-53

TABLE 20

FRESH AND FROZEN FILLETS: IMPORTS RELATED TO TOTAL U.S. CONSUMPTION

Year	Imports (Millions of Pounds) (1)	Consumption (Millions of Pounds) (2)	Ratio[1] (1)/(2)
1950	64.5	239.7	26.9
1951	91.4	282.3	32.4
1952	111.9	269.1	41.6
1953	97.4	256.9	37.9
1954	93.6	251.9	37.2
1955	88.2	240.1	36.7
1956	103.8	242.8	42.7
1957	99.7	259.6	38.4
1958	105.9	252.8	41.9
1959	109.6	239.0	45.7
1960	80.9	233.0	34.7
1961	90.4	241.4	37.5
1962	91.5	250.3	36.6
1963	90.7	244.5	37.1
1964	97.1	249.7	38.9
1965	100.5	261.1	38.5
1966	138.6	267.5	51.8
1967	123.1	254.6	48.4
1968	163.2	279.6	58.4

[1] Imports as a percentage of U.S. consumption.

Source: See Tables 11 and A-5.

is 39.8 and for 1954-57 it is 38.8 and it remains at this level until 1966; the average for 1958-65 is 38.9 percent. On the other hand, if the period 1947-53 was used as the standard, the conclusion would be that imports have increased. However, for the purpose of explaining the drop in landings prices in the mid- 1950's, the years immediately prior are the relevant ones. This is the reason why the first standard has been used in this study.

We will now turn to the change in demand at the wholesale level. The following equation (No. 7.3, Table 15)shows the variables which determine this demand:

$$\log Qfsp = -.61 \underset{(.17)}{-.46 \log \frac{Pfsp^*}{Pm\&p}} \underset{(.26)}{+ .26 \log Y} \underset{(0.012)}{+ 0.044\, D_1^{**}} + 0.013\, D_2 t^{**}$$

* Significant at 0.05 level
** Significant at 0.01 level

R^2 (Adjusted) =95.7
Durbin-Watson d = 1.83

Where: Qfsp = annual per capita disappearance of fillets, sticks and portions

Pfsp = price index for Qfsp

Pm&p = wholesale price index of meat and poultry

Y = annual per capita disposable income in 1958 dollars

D_1 = dummy variable; 0 for 1950-53, 1 for 1954-68

$D_2 t$ = trend variable starting in 1958, t = 1 for 1958

The two variables which caused a decline in the wholesale demand for fillets, and therefore in the demand for landings, are D_1 which represents the introduction of fish sticks in 1954 and the ratio $\frac{Pfsp}{Pm\&p}$ which increased in 1953 because of a decline in meat and poultry prices in that year. The equation contains two variables, D_2t and Y, that do not have to be taken into account in this analysis. The variable D_2t does not play a role until 1958 and the parameter of log Y is not statistically significant. But even if it were significant its effect would be rather small; a 10 percent increase in Y would lead to a 2.6 percent increase in demand.[10]

The positive sign of the parameter D_1 indicates that the demand for fillets, sticks and portions increased. But the sale of fish sticks are greater than this increase in total demand and therefore the demand for fillets decreased. This decline is equal to the difference between the increase in total demand and the average sales of fish sticks. The parameter 0.044, which gives the increase of log Q in 1954 and the years following, represents an increase in per capita consumption of .194. Average per capita consumption of fish sticks for the period 1954-57 is .334. The difference .140 represents the decline in demand for fillets. This is 8.3 percent of the average annual consumption during 1950-53. Thus a decline

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[10]Estimates of a similar magnitude were obtained for the income elasticity of demand for all fish in a study done by the Food and Agriculture Organization of the United Nations.

See: Food and Agriculture Organization of the United Nations, Agricultural Commodities - Projections for 1970 (Rome, 1962). The table with the elasticities was reprinted in Francis T. Christy and Anthony Scott, The Common Wealth in Ocean Fisheries (Baltimore, Maryland: The John Hopkin's Press, 1965) p.35.

in the wholesale demand of 8.3 percent can be attributed to the introduction of fish sticks. As was pointed out in the introduction to this Chapter, the production of fish sticks led to an increase in imports. Therefore, the decline in demand for fillets which took place when fish sticks were introduced can also be attributed to the increase in imports.

The ratio $\frac{Pfsp}{Pm\&p}$ increased significantly in 1953 (See Table 14). Table 21 shows that Pm&p (the wholesale price index for meat and poultry) decreased in the same year. Therefore, the increase in the ratio has to be attributed to the decrease in the price of meat and poultry.

The magnitude of the drop in wholesale and retail prices of meat and poultry as well as the ratio $\frac{Pfsp}{Pm\&p}$ has been estimated with the aid of regression analyses. The results are found in Table 22. The parameter of the dummy variable "D" is equal to the decline in the price index or the increase of the price ratio. The magnitudes are as follows:

decline of Pm (wholesale):	22.7 index points		(eq. 13.1)
" " Pp "	27.9 "	"	(eq. 13.2)
" " Pm&p "	23.6 "	"	(eq. 13.3)
decline of Pm (retail):	10.2 index points		(eq. 14.1)
" " Pp "	6.2 "	"	(eq. 14.2)
" " Pm&p "	9.2 "	"	(eq. 14.3)
increase of $\frac{Pfsp}{Pm\&p}$	16.2 "	"	(eq. 15.1)

The question that remains to be answered is: Why did the wholesale

TABLE 21

U.S. PRICE INDEXES OF MEAT AND POULTRY 1947-68

Year	WHOLESALE (1957-59=100) Meat	Poultry	Meat and Poultry[1]	RETAIL (1957-59=100) Meat	Poultry	Meat and Poultry[1]
1947	95.1	167.7	105.6	81.1	126.0	87.6
1948	111.3	189.1	124.6	92.2	139.7	99.0
1949	96.5	166.1	106.5	86.7	131.7	93.2
1950	103.6	148.5	110.5	91.4	126.1	96.4
1951	120.2	163.5	127.3	103.6	132.1	108.3
1952	110.8	149.8	117.1	102.6	132.6	107.4
1953	93.0	144.6	100.8	95.8	129.3	100.9
1954	92.4	121.4	96.9	95.3	116.7	98.6
1955	83.5	128.4	89.8	87.7	121.5	92.4
1956	79.8	108.4	84.2	84.8	106.5	88.1
1957	91.9	101.5	93.5	94.2	103.8	95.8
1958	108.9	102.2	107.7	104.9	102.6	104.5
1959	99.2	96.3	98.7	101.0	93.5	99.7
1960	96.8	99.9	97.3	99.2	95.0	98.5
1961	95.1	85.8	93.3	100.5	85.8	97.7
1962	97.8	90.2	96.4	102.5	90.7	100.3
1963	91.5	88.6	91.0	100.9	89.3	98.8
1964	89.0	97.4	90.5	99.4	87.3	97.2
1965	100.8	90.9	98.9	106.9	90.0	103.6
1966	109.9	97.3	107.3	116.8	94.9	112.3
1967	105.4	86.0	101.3	113.8	88.9	108.6
1968	107.7	91.0	104.2	116.4	91.7	111.2

[1]Constructed, using annual quantities as weights (Source of annual quantities: Statistical Abstract of the United States, various years).

Source: United States Department of Labor, Bureau of Labor Statistics Wholesale Prices and Price Indexes, various years.

United States Department of Labor, Bureau of Labor Statistics Retail Prices of Food, various years.

TABLE 22

SUMMARIZED RESULTS OF REGRESSION ANALYSES

Equation	Dependent Variable	a	t	D	R^2	F
13.1	Pm (Wholesale)	102.21	1.16* (.45)	-22.72* (6.0)	44.8	7.3
13.2	Pp (Wholesale)	175.31	-3.20** (.61)	-27.94 (8.22)	90.5	86.2
13.3	Pm&p (Wholesale)	113.67	.46 (.42)	-23.56** (5.63)	62.5	15.0
14.1	Pm (Retail)	87.08	1.67** (.33)	10.24* (4.36)	65.2	16.9
14.2	Pp (Retail)	139.84	-2.42** (.42)	-6.21 (5.57)	86.7	58.7
14.3	Pm&p (Retail)	95.21	.98* (.32)	-9.16* (4.23)	35.4	4.9
15.1	$\frac{Pfsp}{Pm\&p}$	89.87		16.21 (2.87)	65.3	32.0

* Significant at 0.05 level
** Significant at 0.01 level

price index for meat and poultry drop in 1953? Or more specifically: Could this drop be attributed to the drop in the price of groundfish? The answer to the first question is found in Tables 23 and 24; the prices of meat and poultry dropped because the per capita supply of these products increased. Changes in supply can obviously not explain all the changes in price that took place, since demand did not remain unchanged. But the effects of the changes in supply are clearly noticeable in the price series, as will be demonstrated below.

Table 23 shows that the per capita supply of meat products dropped from 160 pounds in 1947 to 147 pounds in 1948. It remained at this level until 1953 when it increased to 157 pounds. A further increase in 1955 brought it back to the 160 pounds level. Until 1951 prices, wholesale prices in particular, were somewhat unstable because of temporary price controls and the effects of the Korean war on demand. The effect of the reduction in the supply of meat during the period 1948-52 can nevertheless be easily observed. Wholesale as well as retail prices increased in 1948 remained at a higher level until 1952 and declined in 1953 (See Table 21). A further drop in price took place in 1955. The (temporary) declines in the per capita supply in 1958 and 1965 resulted in (temporary) price increases in the same years.

The supply of poultry is found in Table 24. The per capita supply of poultry gradually increased from around 20 pounds to over 40 pounds. This upward trend is clearly reflected by the gradual decline

TABLE 23

U.S. SUPPLY OF MEAT: PRODUCTION PLUS IMPORTS MINUS EXPORTS, 1947-68
(Millions of Pounds)

	PRODUCTION	IMPORTS	EXPORTS	SUPPLY OF MEAT	
	(1)	(2)	(3)	Total (1)+(2)-(3)	Per Capita (Pounds)
1947	23,338	64	341	23,061	160.0
1948	21,300	360	138	21,522	146.7
1949	21,662	261	142	21,781	145.9
1950	22,075	384	135	22,324	147.0
1951	21,898	542	157	22,283	144.7
1952	22,994	506	185	23,315	149.1
1953	24,688	438	196	24,930	156.8
1954	25,214	418	171	25,461	157.3
1955	26,895	406	195	27,106	164.2
1956	28,035	363	257	28,141	167.4
1957	26,859	543	269	27,133	158.5
1958	25,658	1,143	169	26,632	153.0
1959	27,319	1,353	198	28,474	160.8
1960	28,237	1,048	196	29,089	161.6
1961	28,611	1,325	199	29,737	162.4
1962	28,974	1,799	188	30,585	164.5
1963	30,582	2,047	263	32,366	171.5
1964	32,697	1,432	315	33,814	176.7
1965	31,539	1,347	231	32,655	168.5
1966	32,625	1,721	232	34,114	174.1
1967	34,238	1,841	246	35,833	181.1
1968	35,275	2,081	288	37,068	185.3

Source: Department of Agriculture Agricultural Statistics, 1967 and 1969.

TABLE 24

U.S. SUPPLY OF POULTRY: PRODUCTION MINUS EXPORTS[1], 1947-68
(Millions of Pounds)

	CHICKENS		TURKEYS		SUPPLY OF POULTRY	
	Production (1)	Exports (2)	Production (3)	Exports[2] (4)	Total (1) + (3) -(2)-(4)	Per Capita (Pounds)
1947	2,706	23	485	n.a.	3,168	22.0
1948	2,563	12	420	n.a.	2,971	20.3
1949	2,991	13	569	n.a.	3,547	23.8
1950	3,174	13	615	n.a.	3,776	24.9
1951	3,433	24	703	n.a.	4,112	26.7
1952	3,443	16	795	n.a.	4,222	27.0
1953	3,567	26	758	n.a.	4,299	27.0
1954	3,743	34	870	n.a.	4,579	28.3
1955	3,572	46	818	n.a.	4,344	26.3
1956	4,217	58	957	n.a.	5,116	30.4
1957	4,404	58	1,034	n.a.	5,380	31.4
1958	5,005	61	1,038	5	5,977	34.3
1959	5,230	142	1,123	12	6,199	35.0
1960	5,208	182	1,156	24	6,158	34.2
1961	5,787	247	1,506	28	7,018	38.3
1962	5,825	262	1,302	37	6,828	36.7
1963	6,048	226	1,355	31	7,146	37.9
1964	6,219	250	1,459	43	7,385	38.6
1965	6,649	191	1,521	58	7,921	40.9
1966	7,309	172	1,685	47	8,775	44.8
1967	7,537	159	1,883	49	9,212	46.5
1968	7,525	154	1,615	40	8,946	44.7

[1] Imports of poultry are negligible.
[2] Prior to 1958 not shown separately, included in exports of chicken.

Source: Department of Agriculture Agricultural Statistics, 1967 and 1969.

of the wholesale and retail prices of this commodity (See Table 21).

The second question whether the drop of meat and poultry prices could be attributed to the drop in the prices of groundfish has to be answered in the negative. On a priori grounds it would seem unlikely for groundfish prices to have a seriously depressing effect on meat and poultry prices; the per capita consumption of groundfish products is little over one percent of that of meat and poultry. This expectation is confirmed by findings of Brandow; the cross elasticities between fish and the different kinds of meats (the relative change in the quantities of meat products over the relative change in the price of fish) are between .00281 and .00436.[11] And if the effect of a change in fish prices on the demand for meat products is very small, the same will hold true for the effect on the price of meat products, because the elasticities of demand for meat products do not differ greatly from one.[12]

The problem on hand is complicated by the fact that the total supply of groundfish products increased at a time when U.S. landings prices and fillet prices declined, and remained low for a number of years. This requires further explanation. As was pointed out before, the supply of groundfish products is made up of two parts: 1) domestic production and 2) imports. We will check what happened to each of these two parts.

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[11] G.E. Brandow, Interrelations Among Demand for Farm Products and Implications for Control of Market Supply. Bulletin 680. (University Park: Pennsylvania State University, 1961) p.17.

[12] E.D. Working, Demand for Meat (Chicago, Ill.: University of Chicago Press, 1954).

The domestic production was discussed in the previous section entitled "Supply to the Landings Market". As might be expected, the decline in landings prices and fillet prices in 1953 and 1954 (See Tables 17 and 12) resulted in a decline in landings and fillet production (See Tables 18 and A-4).[13]

Table A-3 of Appendix 1 shows the imports of groundfish products into the United States. Until 1953 when fish blocks came on the market, these imports took the form of fillets. In 1954 and the years following, substantial quantities of blocks were imported. The net effect of this was a significant increase in the level of imports of groundfish products. This may seem unusual in view of the lower fillet prices during the period 1954-57. However, an analysis of Canadian sales data for cod products yielded two reasons which can account for the increase in imports from a supply point of view. Canadian data were chosen because Canada is the main source of imports, and the analysis was restricted to cod because most fish blocks (which caused the increase in imports) consist of cod fillets. Furthermore, until the 1960's, cod represented two-thirds of all Canadian groundfish landings.

The Canadian sales data are found in Table 25. Until 1959 Canadian producers received a premium for cod blocks, notwithstanding

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[13]Total landings dropped drastically in 1953. This fact could easily be misinterpreted as being inconsistent with the hypothesis that there is a one year lag between landings prices and the quantities landed. However, as was pointed out in Chapter III, the quantity of inputs in 1953 was the same as in 1952; the decline in landings in 1953 was due to the resource.

TABLE 25

SALES OF CANADIAN COD PRODUCTS, 1950-68
(Quantities in millions of pounds, Prices in cents per pound)

Year	Exports to the United States						Sales[1] of Dried Salted Cod	
	Frozen Cod Fillets		Cod Blocks		Total			
	Q	P	Q	P	Q	P	Q	P
1950	24.3	17.1			24.3	17.1	n.a.	n.a.
1951	30.2	17.4			30.2	17.4	n.a.	n.a.
1952	28.0	18.9			28.0	18.9	n.a.	n.a.
1953	27.3[2]	18.0	n.a.	n.a.	27.3	18.0	90.6	15.7
1954	43.5[2]	18.7	n.a.	n.a.	43.5	18.7	100.6	15.2
1955	30.6	17.4	19.4	19.3	49.9	18.2	106.5	14.8
1956	27.6	17.7	21.7	18.3	49.3	18.0	86.9	14.1
1957	29.3	17.9	30.3	18.2	59.6	18.0	94.1	14.0
1958	27.8	19.9	30.7	19.9	58.5	19.9	87.8	15.1
1959	26.7	19.8	31.4	20.0	58.1	19.9	74.4	13.5
1960	16.4	20.2	45.5	19.5	61.8	19.7	75.6	17.0
1961	17.2	22.0	40.5	20.1	57.7	20.6	75.4	17.5
1962	19.0	22.6	47.2	21.1	66.3	21.6	61.1	19.0
1963	18.6	22.1	48.9	21.3	67.5	21.5	68.8	20.3
1964	16.8	23.1	66.5	21.2	83.2	21.5	54.2	24.7
1965	16.3	26.1	67.5	23.8	83.8	24.3	46.2	24.0
1966	18.3	27.7	53.2	23.6	71.5	24.7	46.5	25.6
1967	15.2	25.9	52.8	21.6	68.0	22.5	54.0	27.2
1968	20.1	26.4	59.3	21.4	79.4	22.7	56.6	25.3

[1] Data prior to 1953 are not available for Newfoundland.
[2] Blocks are included with fillets.

Source: Dominion Bureau of Statistics, Trade of Canada, Volume II: Exports, various years.

Department of Fisheries and Forestry, Economic Intelligence and Statistics Division
Fisheries Service, Annual Statistical Review of Canadian Fisheries Vol. 1, 1953-68

the fact that the cost of production of blocks is estimated to be 2 to 3 cents per pound below that of frozen fillets. The increase in demand for blocks was so rapid that it took nine years for the fish block production facilities to catch up with the demand; it was not until 1962 that the prices of fillets and blocks started to reflect relative costs.

In 1955, the first year for which separate data for blocks are available, the price differential was 1.9 cents per pound in favour of blocks. The price of cod blocks therefore raised the average price received by Canadian producers for fillets and blocks. In 1954 it was almost 5 percent above the average for 1950-53, notwithstanding the drop in U.S. fillet prices. Besides this there was the drop of the average production costs which should be added to the price increase to obtain the full gain to the producer. It is this gain to the producer that can explain part of the increase in exports to the United States.

The second reason is also found in Table 24. The prices of dried salted cod declined after 1953 and remained at a low level until 1960. The decline in sales of salted cod points to the fact that cod was diverted from the saltfish market to the frozen fish market, since cod landings remained at the same level. The fact that the 1953 sales of salted cod were below those of 1954 and 1955 should not be misinterpreted. The year 1953 was a poor year for groundfish;

Canadian cod landings were 15 percent below average. The increase in the price for salt cod in 1960 halted the decline in the production temporarily, and it is probably responsible for the drop in the exports of fillets to the United States in that year. However, as is illustrated by the data for 1962-68, additional price increases were required to stop Canadian processors from switching from the salted to the frozen market.

We will now return to the starting point, the ratio $\frac{Pfsp}{Pm\&p}$. It has been demonstrated above that the increase in the ratio $\frac{Pfsp}{Pm\&p}$ in 1953 has to be attributed to the decline in the price of meat and poultry. But the price of meat and poultry is not the only variable that changed. The 8.3 percent decline in demand for fillets resulting from the introduction of fish sticks, had also a depressing effect on Pfsp, since fillets make up a large part of the total (over eighty percent up to 1957). In the absence of this drop in demand, the ratio $\frac{Pfsp}{Pm\&p}$ would have been greater. The change observed in this ratio due to declining meat and poultry prices is therefore an underestimate of the one that would be observed under ceteris paribus conditions.

The regression analysis, employed to measure the increase in the ratio $\frac{Pfsp}{Pm\&p}$, yielded an estimate of 16.2 index points (equation 15.1, Table 22) which is equal to 18.0 percent. Since the equation is in terms of logarithms, the product of the parameter of the ratio and its percentage change gives the change in demand. This product is equal

to 8.3 percent. Thus a decline in demand due to falling meat prices would be 8.3 percent *if* the *ceteris paribus* condition had been met. Since this is not the case, as has been pointed out, the conclusion is that the drop in demand due to declining meat and poultry prices is greater than 8.3 percent.

Conclusion

In the first part of this chapter an estimate was made of the magnitude of the drop in the Atlantic Coast landings prices which took place in the 1950's. The decline was measured in two different ways. When comparing averages the drop was estimated to be 10.1 percent, while with a regression analysis a figure of 8.2 percent was obtained. These results are substantially different from the 28 percent drop found in the Report of the Bureau of Commercial Fisheries dealing with this subject. Two reasons were given to explain the difference: 1) an error in the Bureau's 1949 price which resulted in a price used in the analysis which is greater than the correct one; and 2) the use of an average price instead of a price index. It was demonstrated that with the given quantities, the average price would result in an upward bias in the 1960's. Both reasons could not be established with certainty because of the lack of a description of the construction of the price used in the Bureau's analysis and the absence of a source reference.

In the second part, dealing with the supply, it was found that during the 1953-57 period the quantity supplied was below that of

1947-52. With the aid of the results of F. W. Bell's study it was estimated that if the quantity supplied had not diminished, landings prices would have been 6.1 percent lower. This should be added to the drop in actual landings prices, to obtain an estimate of the effect of the drop in demand on landings prices, ceteris paribus. The sum of the two is 16.2 percent when one approach in estimating the drop is used and 14.3 percent when the other is used.

In the last part, dealing with the demand, it was demonstrated that the decline in demand for landings is to be attributed to 1) declining meat prices and 2) the introduction of fish sticks or the increase in imports which resulted from it. Declining meat and poultry prices resulted in more than an 8.3 percent decline in demand for groundfish at the wholesale level. The estimated decline in demand due to the increase in imports (the introduction of fish sticks) was a further 8.3 percent.[14]

Because the demand for landings is derived from the wholesale demand and the percentage supplied by other countries remained the same, the drop in landings prices is explained by the lower meat and poultry prices and the introduction of fish sticks. Using the first estimate of the drop in landings prices, 16.2 percent, it can be stated that declining meat and poultry prices caused landings prices to drop more than 8.1 percent and the increase in imports (the introduction of fish sticks) caused a further drop in landings prices of less than 8.1 percent. Using the second estimate,

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[14]By coincidence these separate influences yielded identical numerical values.

14.3 percent, meat and poultry prices caused a decline of more than 7.2 percent and the increase in imports caused a further decline of less than 7.2 percent. The conclusion is that dropping meat and poultry prices played a more important role than increasing imports in the decline of landings prices.

The above findings contradict those of the Bureau of Commercial Fisheries. In the Report of the Bureau the drop in landings prices of 1.6 cents per pound, or 28 percent, was attributed to the increase in imports.[15] The question whether any changes in the meat and poultry prices had taken place was not considered. The existence of a relationship, a priori, between meat and poultry prices and fish prices, and the fact that Dr. F. W. Bell (presently Chief of the Branch of Economic Research of the Bureau) had published two articles containing quantitative estimates of this relationship more than one year prior to the appearance of the Report, make this omission difficult to understand. The omission of such a relevant variable as the price of a competing product raises a serious doubt about either the scientific value, or the objectivity, of the Report.

What remains to be done is to apply Bell's findings to the drop in meat and poultry prices in 1953 and the next two years in

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[15] The reasoning that led to this conclusion provides an example of the post hoc, ergo propter hoc fallacy. By the same reasoning the full drop could have been attributed to declining meat and poultry prices. In terms of developing hypotheses this would have represented an improvement; the latter can explain the drop in landings prices in 1953 whereas the one selected cannot because the increase in imports did not take place until 1954 (see table A-3).

order to compare the result with the conclusion of the present study. In one article Dr. Bell makes the following statement:

> "The monthly /consumer price/index of meat and poultry prices averages 4 percent lower than last year, resulting in a decline in fish prices of approximately 5 percent."[16]

Another article provides the parameters of the regression analysis on which the above conclusion[17] is based. Statistically highly significant parameters were found when the landings prices of yellowtail flounder, large haddock, small haddock and cod were related to the consumer price index of meat and poultry. Their values are: 1.75, .88, 2.23, and 1.78 respectively. The only groundfish species for which this parameter is not significant is ocean perch. Since the logarithms of the variables were related, a numerical value greater than one means that a change in the consumer price index of one percent will lead to a change in the landings price of more than one percent.

The drop in the retail meat and poultry prices in 1953 has been estimated with the aid of regression analysis. The result is found in Table 22, equation 14.3. Retail prices of meat and poultry dropped by 9.16 index points, which is 9.2 percent. Using the result of Bell's first study the drop in meat and poultry prices explains a decline in landings prices of $\frac{5}{4} \times 9.2 = 11.5$ percent, leaving a decline of either $16.2 - 11.5 = 4.7$ or $14.3 - 11.5 = 2.8$

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[16] F. W. Bell, "Economic Impact of the Abolition of Meatless Fridays", (New England Business Review, December 1967), p. 16.

[17] F. W. Bell, "The Pope and Price of Fish", p. 1348.

percent to be attributed to the introduction of fish sticks or increasing imports. This result is consistent with and similar to the conclusion of the present study.

Bell's second article contains further evidence in support of the conclusion that the increase in imports in the 1950's did not seriously depress landings prices: the results of the regression analyses point to a weak relation between landings prices and imports. Bell considered two reasons for this. His conclusion is that probably the fundamental reason is that there are two different fish products, fresh and frozen (the fresh being supplied predominantly by the domestic fishery and a large portion of the frozen by foreign countries), each not highly price sensitive to the other.[18]

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[18] Op. cit., p. 1349.

CHAPTER VI

SUMMARY

The aim of this study is to determine the effect of the increase in imports in the mid-1950's on U.S. landings prices. Since the U.S. landings market was found to be reasonably competitive, the price may be expected to be determined by supply and demand. Thus, to answer the question of this study the changes in supply and demand and the factors causing these changes had to be determined.

In preliminary readings the view that landings are not influenced by the current landings price was encountered on several occasions. If this were so and if the same would be true for higher levels of demand, the single-equation method could be used to estimate demand functions. Therefore it was useful to study the nature of the short-run supply. The results of this investigation are found in Chapters II and III.

Chapter II reviews the literature on the nature of the short-run supply and develops the theory. Several writers were found to be of the opinion that the short-run supply curve is perfectly inelastic but none of them provided any evidence. The part dealing with the theory yielded a criteron for testing this hypothesis: the hypothesis only holds true if the quantities of inputs in a certain year are not related to the landings price in that year.

The actual testing of the hypothesis is found in Chapter III. For this purpose data for New England were analysed. The analysis had to be restricted to the period 1947-57, because part of the data required were not available for later years. This was not considered to be a serious problem, because the period 1947-57 provided ample evidence of the existence of a lag between inputs and landings prices; this finding is consistent with the hypothesis outlined above. Furthermore, until future prices can be predicted with considerable accuracy it would seem unlikely that this lag would disappear.

Chapter IV presents the analysis of demand. The conclusion of Chapter III together with evidence that imports and stocks are not to any great extent influenced by current landings prices, justify the use of the single-equation approach for estimating demand equations, as the discussion of the model points out. The analysis of demand had to be carried out because no satisfactory functions for groundfish were uncovered in the literature; the two equations (landings level) that were encountered were found to be incomplete.

The analysis of demand was carried out for the wholesale market using annual data for the period 1950-68. The wholesale market reflects the effects of changes in imports and the introduction of new products plus the well-known variables which influence demand. Because of its closeness (in the marketing chain) to the landings market reasonably accurate estimates can be made of the effects of changes in demand in this market on the landings market.

Several equations were estimated. The following was selected as giving the most accurate picture of the forces at work on the demand side of the wholesale market:

$$\log Qfsp = -.61 \underset{(.17)}{-.46 \log \frac{Pfsp^*}{Pm\&p}} + \underset{(.26)}{.26 \log Y} + \underset{(.012)}{.044 D_1^{**}} + \underset{(.003)}{.013 D_2 t^{**}}$$

*Significant at 0.05 level
**Significant at 0.01 level

R^2 (Adjusted) =95.7
Durbin-Watson d = 1.83

In Chapter V the magnitude of the decline in landings prices in the 1950's was estimated, as well as the changes in supply in the landings market. The effect of the change in supply on landings prices was then estimated and added to the actual drop in landings prices to obtain the magnitude of their decline, had the supply remained the same. The next step was to derive the implications from the changes in wholesale demand for the demand in the landings market. Two variables causing a decline in the demand for landings were isolated: the drop in meat and poultry prices in 1953 and the increase in the imports, which took place in 1954 as a result of the introduction of fish sticks. It was found that no changes took place in the imports of fresh and frozen fillets, the third factor affecting the demand for landings. Therefore the drop in landings prices had to be attributed to the decline in meat and poultry prices and the increase in imports. The proportions were determined by the magnitude of their effect on landings demand.

The question whether the decline in meat and poultry prices

could possibly have been caused by the drop in groundfish prices had to be answered in the negative. An analysis of production data for meat and poultry made it clear that the changes in prices stemmed from changes in the per capita supply of these products. The magnitudes of cross elasticities between fish and meat products together with elasticities of demand for meat formed additional evidence in support of the conclusion that the drop in meat and poultry could not be attributed to declining fish prices.

The increase in exports to the United States in 1954 took place after U.S. fillet prices had declined. This may seem somewhat unusual, but an analysis of Canadian export data provides the explanation. It was found that the price received for foreign producers in 1954 and later years was actually above the 1950-52 average, because fish blocks sold at a premium for a number of years. At the same time their average cost per pound had fallen because the cost of production of blocks is below that of fillets. The second reason why exports of frozen fillets and blocks to the United States increased is found in the salt fish market: salt fish prices declined after 1953 and remained low until 1960, resulting in an increase in the supply of frozen product.

The conclusion of this study is that imports caused landings prices to drop by less than 8.1 percent. This estimate is substantially different from the 28 percent estimate made by the United States Bureau of Commercial Fisheries. But it is consistent with the implications of findings of F.E. Bell, who estimated the

relationship between landings prices and meat and poultry prices. Applying his findings to the drop in meat and poultry prices, an 11.5 percent drop in landings prices is explained by the decline in meat and poultry prices, leaving at the most 4.7 percent to be explained by the increase in imports.

The conclusion of the present study is of considerable interest to the Canadian fishery because it shows that the injury to the U.S. fishery resulting from the increase in imports has been grossly overestimated. It therefore destroys a substantial part of the claim of those who wish to press for the imposition of tariffs and quota on the imports of groundfish products.

TABLE A-1

U.S. STOCKS OF FROZEN GROUNDFISH FILLETS, BLOCKS, STICKS AND PORTIONS ON JANUARY 1ST.
(Millions of Pounds)

Year	Cod	Haddock	Ocean Perch	Flounder	Total Fillets	Blocks[1]	Total Fillets and Blocks	Sticks and Portions
1950	6.4	3.7	14.1	2.9	27.1		27.1	
1951	9.2	13.2	9.7	3.6	35.7		35.7	
1952	3.7	5.8	20.8	5.6	35.9		35.9	
1953	15.4	11.1	18.8	6.6	51.9	n.a.	51.9	n.a.
1954	8.4	8.5	14.5	5.3	36.7	n.a.	36.7	n.a.
1955	9.6	15.0	17.7	2.9	45.2	11.7	56.9	n.a.
1956	7.0	6.6	16.5	5.7	35.8	13.1	48.9	6.1
1957	10.3	11.4	23.5	5.0	50.2	10.9	61.1	5.7
1958	6.8	5.6	15.1	5.7	33.2	8.9	42.1	5.2
1959	6.5	5.0	15.8	5.2	32.5	15.4	47.9	6.2
1960	14.4	10.2	14.9	5.7	45.2	23.2	68.4	6.9
1961	7.8	8.1	13.7	7.5	37.1	24.8	61.9	9.1
1962	7.1	10.3	13.0	6.1	36.5	17.7	54.2	10.5
1963	9.7	5.4	13.5	6.2	34.8	24.3	59.1	11.6
1964	8.9	4.8	16.3	8.0	38.0	25.8	63.8	13.6
1965	6.2	7.4	15.4	9.0	38.0	20.0	58.0	8.1
1966	5.7	6.9	12.2	6.6	31.4	37.4	68.8	14.2
1967	12.7	7.9	17.9	10.2	48.7	35.2	83.9	19.5
1968	6.5	6.9	18.0	10.7	42.1	32.3	74.4	14.0
1969	7.6	4.8	19.7	7.8	39.9	44.4	84.3	24.0

[1] Included with the various fillets up to 1954.

Source: Bureau of Commercial Fisheries, Frozen Fishery Products, 1950-68.

TABLE A-2

U.S. LANDINGS[1] OF GROUNDFISH
(Millions of Pounds)

Year	Cod	Haddock	Ocean Perch	Flounder	Total
1950	20.9	55.7	62.3	44.9	183.8
1951	19.1	54.1	77.5	40.4	191.1
1952	17.4	56.7	58.7	40.4	173.2
1953	13.2	49.0	48.0	34.1	144.3
1954	17.1	54.4	57.8	37.5	166.8
1955	15.5	47.4	49.1	37.6	149.6
1956	14.3	53.4	48.4	39.3	155.4
1957	14.7	46.9	42.9	40.0	144.5
1958	17.2	42.0	46.5	42.6	148.3
1959	19.1	39.5	43.3	41.5	143.4
1960	14.7	41.7	45.1	43.3	144.8
1961	16.0	46.9	43.3	45.4	151.6
1962	16.2	47.1	42.4	53.0	158.7
1963	15.6	43.5	39.6	60.3	159.0
1964	14.5	46.9	33.1	60.1	154.6
1965	14.8	47.0	33.8	61.3	156.9
1966	15.2	46.4	31.1	59.5	152.2
1967	16.7	34.6	27.7	52.1	131.1
1968	17.5	24.6	22.4	53.1	117.6

[1]Converted to fillet weight.
The following conversion factors were used: Cod .320, Haddock .351, Ocean Perch .300, Flounder .341.

Source: Derived from Bureau of Commercial Fisheries, Fishery Statistics of the U.S., 1950-54.

Bureau of Commercial Fisheries, Food Fish Situation and Outlook Annual Review, 1966 and 1968.

TABLE A-3

U.S. IMPORTS OF FRESH AND FROZEN GROUNDFISH FILLETS AND BLOCKS, STICKS AND PORTIONS
(Millions of Pounds)

Year	Cod	Haddock	Ocean Perch	Flounder[1]	Total Fillets[2]	Blocks	Total Fillets and Blocks	Sticks and Portions
1950	n.a.	n.a.	n.a.	4.5	64.5		64.5	
1951	n.a.	n.a.	n.a.	8.6	91.4		91.4	
1952	n.a.	n.a.	n.a.	9.3	111.9		111.9	
1953	n.a.	n.a.	n.a.	12.5	97.4	n.a.	97.4	n.a.
1954	84.4	25.3	23.6	10.3	93.6	50.0[3]	143.6	n.a.
1955	37.2	20.3	17.9	12.8	88.2	48.2	136.4	.2
1956	43.5	25.5	21.6	13.2	103.8	38.9	142.7	.2
1957	45.5	23.0	16.7	14.5	99.7	50.2	149.9	.1
1958	48.6	20.7	21.8	14.8	105.9	76.2[4]	182.1	.1
1959	54.9	22.3	17.9	14.5	109.6	85.3	194.9	.0
1960	29.6	18.2	14.4	18.7	80.9	89.7	170.6	.2
1961	32.2	21.1	18.7	18.4	90.4	118.6	209.0	.5
1962	33.0	20.6	19.5	18.4	91.5	143.5	235.0	.3
1963	32.7	19.8	21.6	16.6	90.7	153.3	244.0	.4
1964	33.5	19.1	22.9	21.6	97.1	166.2	263.3	.2
1965	33.7	17.0	25.7	24.1	100.5	214.8	315.3	.3
1966	40.8	21.5	41.6	34.7	138.6	206.5	345.1	.4
1967	32.1	21.4	36.3	33.3	123.1	189.5	312.6	.4
1968	46.6	26.7	50.4	39.5	163.2	261.1	424.3	.9

[1]Prior to 1954, imports were not broken down into species. Since almost all flounder fillets were imported from Canada, Canadian export data were used for the years 1950-53.

[2]For the years 1950-53 the average quantity of cusk, hake and pollock for 1954-58 (4.8 million pounds) was subtracted from the total.

[3]Estimated on the basis of the production of fish sticks.

[4]Estimated by the Bureau of Commercial Fisheries.

Source: Bureau of Commercial Fisheries, Imports and Exports of Fishery Products, 1950-68.

TABLE A-4

U.S. PRODUCTION OF FRESH AND FROZEN GROUNDFISH FILLETS AND BLOCKS
(Millions of Pounds)

Year	Fresh Fillets					Frozen Fillets					Blocks	Total Fillets and Blocks
	Cod (1)	Haddock (2)	Ocean Perch (3)	Flounder (4)	Total (5)	Cod (6)	Haddock (7)	Ocean Perch (8)	Flounder (9)	Total (10)	(11)	(5+10+11)
1950	8.7	22.5	2.4	15.8	49.4	4.4	28.7	60.8	12.5	106.4		155.8
1951	7.5	22.4	1.4	11.9	43.2	5.8	28.5	73.6	14.4	122.3		165.5
1952	6.6	24.1	8.5	11.7	50.9	5.1	27.9	50.1	12.5	95.6		146.5
1953	5.9	20.1	1.9	11.3	39.2	5.5	24.3	48.3	9.7	87.8	n.a.	127.0
1954	7.0	20.9	1.8	9.6	39.3	5.3	26.0	56.8	10.7	98.8	n.a.	138.1
1955	6.7	18.9	1.3	12.9	39.8	5.0	19.4	48.9	9.7	83.0	7.1	129.9
1956	5.7	22.8	1.9	13.0	43.4	4.5	21.4	46.2	8.8	80.9	2.0	126.3
1957	5.5	22.4	1.0	14.4	43.3	4.5	17.1	41.1	9.9	72.6	1.6	117.5
1958	7.7	18.8	1.0	13.7	41.2	4.1	14.6	44.6	10.8	74.1	2.1	117.4
1959	8.0	16.7	1.1	16.0	41.8	4.5	13.9	40.6	8.4	67.4	1.3	110.5
1960	6.1	19.6	1.7	17.4	44.8	3.3	13.7	44.7	10.6	72.3	.8	117.9
1961	6.6	21.3	2.3	21.3	51.5	3.1	16.9	38.9	10.2	69.1	1.2	121.8
1962	7.0	24.1	2.2	24.8	58.0	2.7	17.5	38.5	13.4	72.1	1.6	131.8
1963	6.8	23.6	2.9	28.4	61.7	3.0	13.1	34.2	15.7	66.0	2.0	129.7
1964	7.2	23.6	2.6	32.4	65.8	2.9	13.7	26.7	13.1	56.4	2.0	124.2
1965	7.1	24.0	5.4	35.3	71.8	2.8	16.1	25.4	14.3	58.6	2.9	133.3
1966	6.0	22.7	3.4	33.1	65.2	4.2	17.4	24.7	16.5	62.8	6.0	134.0
1967	7.8	23.1	3.1	33.4	67.4	6.2	10.9	21.7	11.7	50.5	6.2	124.1
1968	9.2	17.6	2.8	35.4	65.0	4.4	4.7	16.4	8.2	33.7	3.6	102.6

Source: Bureau of Commercial Fisheries, Packaged Fishery Products, 1950-68.

Bureau of Commercial Fisheries, Frozen Fishery Products, 1950-68.

TABLE A-5

AVERAGE PRICES RECEIVED BY U.S. PROCESSORS OF GROUNDFISH
(Cents Per Pound, Current Dollars)

Year	Fresh Fillets				Frozen Fillets				Blocks[1]	Sticks	Portions
	Cod	Haddock	Ocean Perch	Flounder	Cod	Haddock	Ocean Perch	Flounder			
1950	25.4	29.4	18.6	36.1	20.9	26.7	24.2	33.6			
1951	28.0	30.2	21.3	43.7	22.9	27.3	25.0	39.0			
1952	27.7	31.8	25.2	43.1	23.4	27.6	24.0	38.6			
1953	26.3	30.7	21.2	41.0	24.3	28.2	22.7	34.0	n.a.	n.a.	
1954	24.4	27.0	19.5	42.6	21.7	22.9	22.8	33.2	22.3	53.0	
1955	24.9	28.5	19.6	42.1	22.4	23.0	22.9	33.3	22.1	45.8	n.a.
1956	27.5	27.7	20.0	44.3	22.8	23.1	22.6	33.5	21.2	43.9	n.a.
1957	26.9	32.1	24.5	42.3	21.9	27.1	20.5	32.9	21.6	44.3	n.a.
1958	30.6	36.4	25.1	42.8	25.5	32.6	24.4	34.8	21.8	44.3	36.6
1959	30.8	35.3	24.4	43.3	24.0	30.5	24.4	33.4	21.0	47.4	35.4
1960	32.0	35.1	23.3	43.6	26.5	28.8	23.4	33.0	21.6	44.0	25.5
1961	35.1	33.6	23.6	41.9	25.7	28.8	25.2	32.1	21.8	43.1	37.1
1962	34.8	36.6	23.3	39.4	26.7	30.7	26.3	32.2	20.8	41.6	35.7
1963	36.2	38.2	23.4	38.4	26.8	32.6	27.5	31.0	21.5	39.8	35.8
1964	34.8	38.7	23.1	37.9	29.0	33.3	26.2	31.2	23.3	40.8	34.4
1965	36.8	43.2	22.8	42.6	31.9	36.7	26.8	36.4	25.4	43.4	39.9
1966	41.2	44.7	25.4	47.6	33.4	39.1	26.9	42.5	26.0	44.0	39.3
1967	40.2	48.2	26.7	47.6	30.2	38.7	26.7	40.6	23.9	44.1	36.3
1968	42.1	52.3	28.8	48.4	31.2	41.7	26.0	42.0	22.6	45.2	37.6

[1]Average price of imports including the tariff.

Source: Computed from Bureau of Commercial fisheries, Fishery Statistics of the United States, 1950-68.

TABLE B-1

SOURCES AND DISPOSITION OF FRESH AND FROZEN GROUNDFISH FILLETS[1]
(Millions of Pounds)

	SOURCES				DISPOSITION			
Year	Beginning Stocks	Landings[2]	Imports	Total	Domestic Block Production	Ending Stocks	Apparent Consumption Total	Pounds Per Capita
1950	27.1	183.8	64.5	275.4		35.7	239.7	1.578
1951	35.7	191.1	91.4	318.2		35.9	282.3	1.833
1952	35.9	173.2	111.9	321.0		51.9	269.1	1.721
1953	51.9	144.3	97.4	293.6	n.a.	36.7	256.9	1.616
1954	36.7	166.8	93.6[3]	297.1	n.a.	45.2	251.9	1.556
1955	45.2	149.6	88.2	283.0	7.1	35.8	240.1	1.454
1956	35.8	155.4	103.8	295.0	2.0	50.2	242.8	1.444
1957	50.2	144.5	99.7	294.4	1.6	33.2	259.6	1.516
1958	33.2	148.3	105.9	287.4	2.1	32.5	252.8	1.452
1959	32.5	143.4	109.6	285.5	1.3	45.2	239.0	1.350
1960	45.2	144.8	80.9	270.9	.8	37.1	233.0	1.295
1961	37.1	151.6	90.4	279.1	1.2	36.5	241.4	1.318
1962	36.5	158.7	91.5	286.7	1.6	34.8	250.3	1.346
1963	34.8	159.0	90.7	284.5	2.0	38.0	244.5	1.296
1964	38.0	154.6	97.1	289.7	2.0	38.0	249.7	1.305
1965	38.0	156.9	100.5	295.4	2.9	31.4	261.1	1.347
1966	31.4	152.2	138.6	322.2	6.0	48.7	267.5	1.366
1967	48.7	131.1	123.1	302.9	6.2	42.1	254.6	1.286
1968	42.1	117.6	163.2	322.9	3.5	39.9	279.5	1.398

[1]Cod, haddock, ocean perch and flounder.

[2]Converted to fillet weight.

[3]The total was reduced by fifty million pounds, the estimate for the imports of blocks.

Source: Tables A-1 to A-4.

TABLE B-2

SOURCES AND DISPOSITION OF FROZEN GROUNDFISH BLOCKS
(Million Pounds)

Year	SOURCES				DISPOSITION		
	Beginning Stocks	Production	Imports	Total	Ending Stocks	Apparent Consumption Total	Apparent Consumption Pounds Per Capita
1953	n.a.[1]	n.a.[1]	n.a.[1]		n.a.[1]	n.a.[1]	n.a.[1]
1954	n.a.[1]	n.a.[1]	50.0		11.7	40.0[2]	.247
1955	11.7	7.1	48.2	67.0	13.1	53.9	.326
1956	13.1	2.0	38.9	54.0	10.9	43.1	.256
1957	10.9	1.6	50.2	62.7	8.9	53.8	.314
1958	8.9	2.1	76.2	87.2	15.4	71.8	.412
1959	15.4	1.3	85.3	102.0	23.2	78.8	.445
1960	23.2	.8	89.7	113.7	24.8	88.9	.493
1961	24.8	1.2	118.6	144.6	17.7	126.9	.693
1962	17.7	1.6	143.5	162.8	24.3	138.5	.745
1963	24.3	2.0	153.3	179.6	25.8	153.8	.815
1964	25.8	2.0	166.2	194.0	20.0	174.0	.909
1965	20.0	2.9	214.8	237.7	37.4	200.3	1.034
1966	37.4	6.0	206.6	250.0	35.2	214.8	1.097
1967	35.2	6.2	189.5	230.9	32.3	198.6	1.004
1968	32.3	3.6	261.1	297.0	44.4	252.6	1.263

[1]Included with the various fillets.

[2]Estimated, taking into account the stock on January 1, 1955.

Source: Tables A-1, A-3 and A-4.

TABLE B-3

SOURCES AND DISPOSITION OF FISH STICKS AND PORTIONS
(Millions of Pounds)

Year	SOURCES: Beginning Stocks	Production: Sticks	Production: Portions	Production: Total	Imports	Total	DISPOSITION: Ending Stocks	Apparent Consumption[1]: Total	Apparent Consumption[1]: Pounds Per Capita
1953	n.a.	7.5						n.a.[2]	n.a.[2]
1954	n.a.	50.0						47.0	.290
1955	n.a.	63.0	n.a.	n.a.	.2	n.a.	n.a.	60.0	.363
1956	6.1	52.8	n.a.	n.a.	.2	n.a.	5.7	53.2	.316
1957	5.7	53.1	n.a.	n.a.	.1	n.a.	5.2	63.0	.368
1958	5.2	61.0	21.8	82.8	.1	88.1	6.2	81.9	.470
1959	6.2	60.4	37.1	97.5	.0	103.7	6.9	96.8	.547
1960	6.9	65.1	49.4	114.5	.2	121.6	9.1	112.5	.625
1961	9.1	69.8	59.8	129.7	.5	139.3	10.5	128.8	.703
1962	10.5	72.2	78.7	150.9	.3	161.7	11.6	150.1	.807
1963	11.6	79.3	94.6	173.9	.4	185.9	13.6	172.3	.913
1964	13.6	73.6	106.3	179.9	.2	193.7	8.1	185.6	.970
1965	8.1	82.5	140.5	222.9	.3	231.3	14.2	217.1	1.120
1966	14.2	81.4	147.6	229.0	.4	243.6	19.5	224.1	1.144
1967	19.5	73.9	158.3	232.3	.4	252.2	14.0	238.2	1.203
1968	14.0	91.6	179.2	270.7	.9	285.6	24.0	261.6	1.313

[1]Estimated for the years 1954-57 on the basis of the disappearance of blocks.

[2]Included with fillets.

Source: Bureau of Commercial Fisheries, Fish Sticks, Fish Portions and Breaded Shrimp, Annual Summary, 1964 and 1968.

Table A-1.

TABLE B-4

SOURCES AND DISPOSITION OF FRESH GROUNDFISH FILLETS

(Millions of Pounds)

	SOURCES								DISPOSITION	
	Cod			Haddock			Ocean Perch[2]	Flounder[2]	Apparent Consumption	
Year	Production	Imports[1]	Total	Production	Imports[1]	Total	Production	Production	Total	Pounds per Capita
1950	8.7	5.1	13.8	22.5	1.2	23.7	2.4	15.8	55.7	.367
1951	7.5	6.8	14.3	22.4	1.3	23.7	1.4	11.9	51.3	.333
1952	6.6	5.8	12.4	24.1	1.3	25.4	8.5	11.7	58.0	.371
1953	5.9	5.3	11.2	20.1	.9	21.0	1.9	11.3	45.4	.289
1954	7.0	4.8	11.8	20.9	.8	21.7	1.8	9.6	44.9	.277
1955	6.7	4.1	10.8	18.9	.9	19.8	1.3	12.9	44.8	.271
1956	5.7	5.7	11.4	22.8	1.6	24.4	1.9	13.0	50.7	.302
1957	5.5	6.0	11.5	22.4	1.0	23.4	1.0	14.4	50.3	.294
1958	7.7	6.2	13.9	18.8	1.3	20.1	1.0	13.7	48.7	.280
1959	8.0	2.9	10.9	16.7	1.1	17.8	1.1	16.0	45.8	.259
1960	6.1	4.5	10.6	19.6	1.1	20.7	1.7	17.4	50.4	.280
1961	6.6	3.3	9.9	21.3	1.1	22.4	2.3	21.3	55.9	.305
1962	7.0	3.6	10.6	24.1	1.0	25.1	2.2	24.8	62.7	.337
1963	6.8	3.9	10.7	23.6	1.4	25.0	2.9	28.4	67.0	.355
1964	7.2	4.3	11.5	23.6	1.8	25.4	2.6	32.4	71.9	.376
1965	7.1	5.1	12.2	24.0	2.1	26.1	5.4	35.3	79.0	.408
1966	6.0	6.5	12.5	22.7	2.9	25.6	3.4	33.1	74.6	.381
1967	7.8	5.8	13.6	23.1	4.5	27.6	3.1	33.4	77.7	.393
1968	9.2	5.7	14.9	17.6	4.4	22.0	2.8	35.4	75.1	.376

[1] Imported from Canada.

[2] Imports are negligible.

Source: Table A-3.

Dominion Bureau of Statistics, Exports by Commodities, 1950-68.

TABLE B-5

SOURCES AND DISPOSITION OF FROZEN COD FILLETS

(Millions of Pounds)

Year	Sources						Disposition		
	Beginning Stocks	Production	Imports			Total	Ending Stocks	Apparent Consumption	
			Fresh & Frozen	Fresh[1]	Frozen			Total	per Capita
1950	6.4	4.4	n.a.	5.1	n.a.	n.a.	9.2	n.a.	n.a.
1951	9.2	5.8	n.a.	6.8	n.a.	n.a.	3.7	n.a.	n.a.
1952	3.7	5.1	n.a.	5.8	n.a.	n.a.	15.4	n.a.	n.a.
1953	15.4	5.5	n.a.	5.3	n.a.	n.a.	8.4[2]	n.a.	n.a.
1954	8.4[2]	5.3	84.4[2]	4.8	79.6[2]	93.3[2]	9.6[2]	83.7[2]	.517[2]
1955	9.6	5.0	37.2	4.1	33.1	47.7	7.0	40.7	.247
1956	7.0	4.5	43.5	5.7	37.8	49.3	10.3	39.0	.232
1957	10.3	4.5	45.5	6.0	39.5	54.3	6.8	47.5	.278
1958	6.8	4.1	48.6	6.2	42.4	53.3	6.5	46.8	.269
1959	6.5	4.5	54.6	2.9	51.7	62.7	14.4	48.3	.273
1960	14.4	3.3	29.6	4.5	25.1	42.8	7.8	35.0	.194
1961	7.8	3.1	32.2	3.3	28.9	39.8	7.1	32.7	.179
1962	7.1	2.7	33.0	3.6	29.4	39.2	9.7	29.5	.159
1963	9.7	3.0	32.7	3.9	28.8	41.5	8.9	32.6	.173
1964	8.9	2.9	33.5	4.3	29.2	41.0	6.2	34.8	.182
1965	6.2	2.8	33.7	5.1	28.6	37.6	5.7	31.9	.165
1966	5.7	4.2	40.8	6.5	34.3	44.2	12.7	31.5	.161
1967	12.7	6.2	32.1	5.8	26.3	45.2	6.5	38.7	.196
1968	6.5	4.4	46.6	5.7	40.9	51.8	7.6	44.2	.221

[1] Imported from Canada

[2] Includes blocks

Source: Tables A-1, A-3, A-4 and B-4.

TABLE B-6

SOURCES AND DISPOSITION OF FROZEN HADDOCK FILLETS
(Millions of Pounds)

Year	Beginning Stocks	Production	Sources	Imports		Total	Disposition	Apparent Consumption	
			Fresh & Frozen	Fresh[1]	Frozen		Ending Stocks	Total	per Capita
1950	3.7	28.7	n.a.	1.2	n.a.	n.a.	13.2	n.a.	n.a.
1951	13.2	28.5	n.a.	1.3	n.a.	n.a.	5.8	n.a.	n.a.
1952	5.8	27.9	n.a.	1.3	n.a.	n.a.	11.1	n.a.	n.a.
1953	11.1	24.3	n.a.	.9	n.a.	n.a.	8.5	n.a.	n.a.
1954	8.5	26.0	25.3[2]	.8	24.5	59.0	15.0	44.0	.272
1955	15.0	19.4	20.3	.9	19.4	53.8	6.6	47.2	.286
1956	6.6	21.4	25.5	1.6	23.9	51.9	11.4	40.5	.241
1957	11.4	17.1	23.0	1.0	22.0	50.5	5.6	44.9	.262
1958	5.6	14.6	20.7	1.3	19.4	39.6	5.0	34.6	.199
1959	5.0	13.9	22.3	1.1	21.2	40.1	10.2	29.9	.169
1960	10.2	13.7	18.2	1.1	17.1	41.0	8.1	32.9	.183
1961	8.1	16.9	21.1	1.1	20.0	45.0	10.3	34.7	.190
1962	10.3	17.5	20.6	1.0	19.6	47.4	5.4	42.4	.228
1963	5.4	13.1	19.8	1.4	18.4	36.9	4.8	32.1	.170
1964	4.8	13.7	19.1	1.8	17.3	35.8	7.4	28.4	.148
1965	7.4	16.1	17.0	2.1	14.9	38.4	6.9	31.5	.163
1966	6.9	17.4	21.5	2.9	18.6	42.9	7.9	35.0	.179
1967	7.9	10.9	21.4	4.5	16.9	35.7	6.9	28.8	.146
1968	6.9	4.7	26.7	4.4	22.3	33.9	4.8	29.1	.146

[1] Imported from Canada

[2] Includes blocks

Source: Tables A-1, A-3, A-4 and B-4.

TABLE B-7

SOURCES AND DISPOSITION OF FROZEN OCEAN PERCH FILLETS
(Millions of Pounds)

Year	Sources				Disposition		
	Beginning Stocks	Production	Imports	Total	Ending Stocks	Apparent Total	Consumption per Capita
1950	14.1	60.8	n.a.	n.a.	9.7	n.a.	n.a.
1951	9.7	73.6	n.a.	n.a.	20.8	n.a.	n.a.
1952	20.8	50.1	n.a.	n.a.	18.8	n.a.	n.a.
1953	18.8	48.3	n.a.	n.a.	14.5	n.a.	n.a.
1954	14.5	56.8	23.6	94.9	17.7	77.2	.477
1955	17.7	48.9	17.9	84.5	16.5	68.0	.412
1956	16.5	46.2	21.6	84.3	23.5	60.8	.362
1957	23.5	41.1	16.7	81.3	15.1	66.2	.387
1958	15.1	44.6	21.8	81.5	15.8	65.7	.377
1959	15.8	40.6	17.9	74.3	14.9	59.4	.335
1960	14.9	44.7	14.4	74.0	13.7	60.3	.335
1961	13.7	38.9	18.7	71.3	13.0	58.3	.318
1962	13.0	38.5	19.5	71.0	13.5	57.5	.309
1963	13.5	34.2	21.6	69.3	16.3	53.0	.281
1964	16.3	26.7	22.9	65.9	15.4	50.5	.264
1965	15.4	25.4	25.7	66.5	12.2	54.3	.280
1966	12.2	24.7	41.6	78.5	17.9	60.6	.309
1967	17.9	21.7	36.3	75.9	18.0	57.9	.293
1968	18.0	17.4	50.4	85.8	19.7	66.1	.331

Source: Tables A-1, A-3, and A-4.

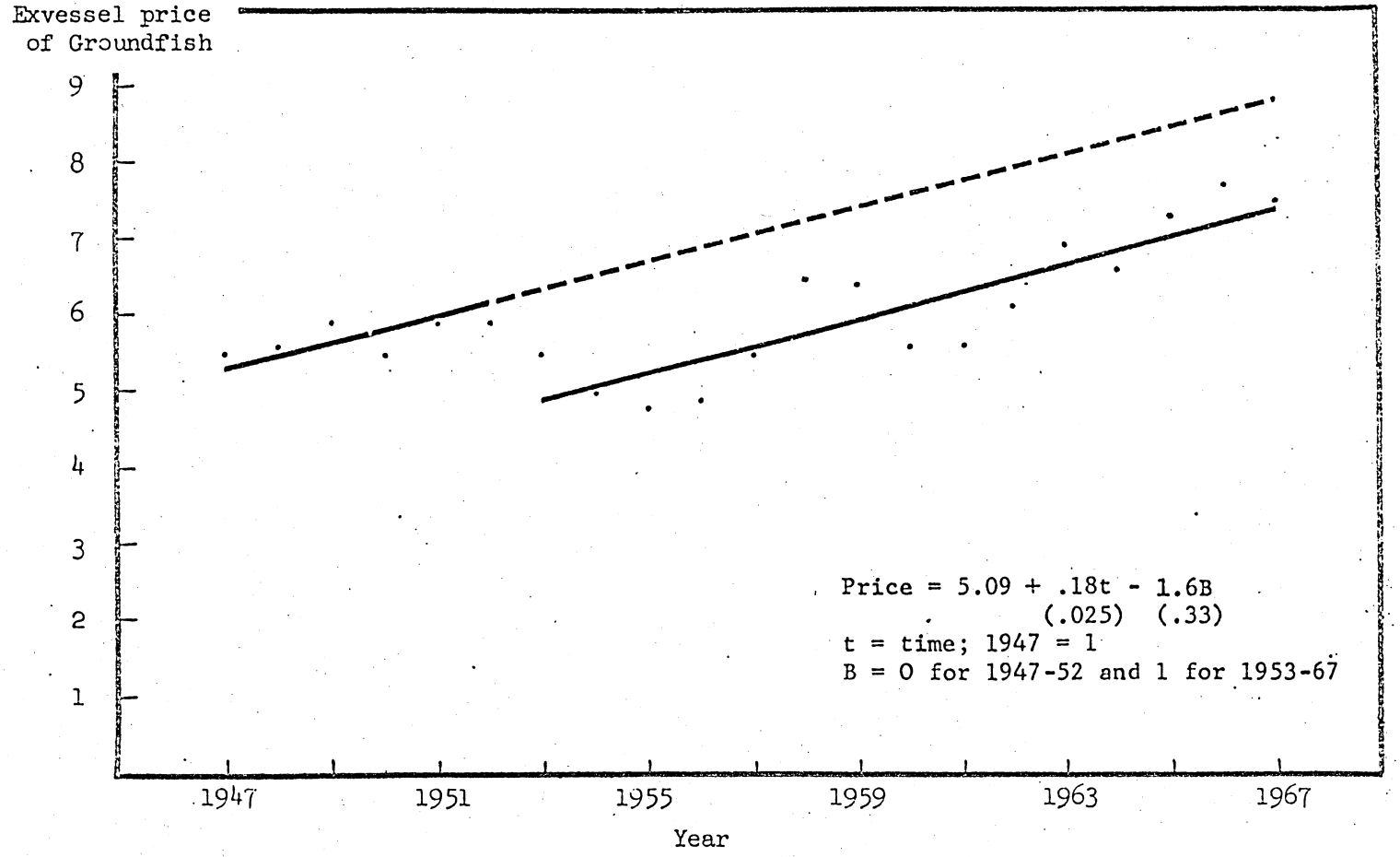
TABLE B-8

SOURCES AND DISPOSITION OF FROZEN FLOUNDER FILLETS
(Millions of Pounds)

Year	Sources				Disposition		
	Beginning Stocks	Production	Imports	Total	Ending Stocks	Apparent Total	Consumption per Captia
1950	2.9	12.5	4.5	19.9	3.6	16.3	.107
1951	3.6	14.4	8.6	26.6	5.6	21.0	.142
1952	5.6	12.5	9.3	27.4	6.6	20.8	.133
1953	6.6	9.7	12.5	28.8	5.3	23.5	.148
1954	5.3	10.7	10.3	26.3	2.9	23.4	.145
1955	2.9	9.7	12.8	25.4	5.7	19.7	.119
1956	5.7	8.8	13.2	27.7	5.0	22.7	.135
1957	5.0	9.9	14.5	29.4	5.7	23.7	.138
1958	5.7	10.8	14.8	31.3	5.2	26.1	.150
1959	5.2	8.4	14.5	28.1	5.7	22.4	.127
1960	5.7	10.6	18.7	35.0	7.5	27.5	.153
1961	7.5	10.2	18.4	36.1	6.1	30.0	.164
1962	6.1	13.4	18.4	37.9	6.2	31.7	.171
1963	6.2	15.7	16.6	38.5	8.0	30.5	.162
1964	8.0	13.1	21.6	42.7	9.0	33.7	.176
1965	9.0	14.3	24.1	47.4	6.6	40.8	.211
1966	6.6	16.5	34.7	57.8	10.2	47.6	.242
1967	10.2	11.7	33.3	55.2	10.7	44.5	.225
1968	10.7	8.2	39.5	58.4	7.8	50.6	.253

Source: Tables A-1, A-3 and A-4.

Figure 13. The Effect of Imports on the Trend in Exvessel Price of Groundfish, 1947-67



U.S. Department of the Interior — Bureau of Commercial Fisheries

Source: Department of the Interior, Report of the Secretary of the Interior to the President and the Congress on The Effects of Imports on the United States Groundfish Industry, Figure 13, p. 55.

TABLE C-2

COMPARISON OF AVERAGE LANDINGS PRICES
(Cents per Pound)

	Ex Vessel Price of Groundfish (1)	Average Landings Price of Groundfish Atlantic Coast (U.S.) (2)
1947	5.5	6.1
1948	5.6	6.3
1949	5.9	5.5
1950	5.5	6.4
1951	5.9	6.9
1952	5.9	6.9
1953	5.5	6.6
1954	5.0	6.1
1955	4.7	6.0
1956	4.9	6.0
1957	5.5	6.8
1958	6.5	7.5
1959	6.4	7.6
1960	5.6	6.7
1961	5.6	6.6
1962	6.1	7.2
1963	6.8	7.6
1964	6.6	7.5
1965	7.3	8.7
1966	7.7	9.6
1967	7.5	9.4

Source: (1) Department of the Interior, Report of the Secretary of the Interior to the President and the Congress on The Effects of Imports on the United States Groundfish Industry, Figure 13, p.55.

(2) Table 17

BIBLIOGRAPHY

Anderson, R. L. "The Problem of Autocorrelation in Regression Analysis". Journal American Statistical Association, XLIX (1954), 113-129.

Atlantic Provinces Economic Council, Atlantic Provinces Fishery. Pamphlet No. 12, Fredericton, N.B.; 1968.

Beach, E. F. Economic Models - An exposition. New York: John Wiley and Sons, 1957.

Bell, F. W. The Economics of the New England Fishing Industry: The Role of Technological Change and Government Aid. Research Report to the Federal Reserve Bank of Boston, No. 31, 1966.

---------. "Economic Impact of the Abolition of Meatless Fridays". New England Business Review, (December 1967), 9-17.

---------. "The Pope and the Price of Fish". The American Economic Review, LVIII No. 5, part 1 (December 1968).

---------, and J. E. Hazleton, eds. Recent Developments and Research in Fisheries Economics. Dobbs Ferry, N.Y.: Oceana Publications, Inc. (For the New England Economic Research Foundation), 1967.

Brandow, G. E. Interrelations among Demands for Farm Products and Implications for Control of Market Supply. Bulletin 680. University Park: Pennsylvania State University, 1961.

Christy, F. T., Jr., and A. Scott. The Common Wealth in Ocean Fisheries. Baltimore: Johns Hopkins University Press (for Resources for the future Inc.), 1965.

Copes, Parzaval. Government Assistance, Productivity and Income in the Fishing Industry in Newfoundland (mimeograph) St. John's, Newfoundland: Memorial University of Newfoundland, 1964.

Croxton, F. E., and D. J. Cowden. Applied General Statistics. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1959.

Durbin, J. "Estimation of Parameters in Time-series Regression Models". Journal Royal Statistical Society, Series B, XXII (1960).

---------, and G. S. Watson. "Testing for Serial Correlation in Least-squares Regression". Biometrika, Parts I and II, 1950 and 1951.

European Productivity Agency. Marketing and Consumption of Frozen Fish in OEEC Countries. Paris: Organization for Economic Co-Operation and Development, 1960.

---------. Fish Marketing in Western Europe since 1950. Paris: Organization for European Economic Co-Operation, 1957.

Farrel, J. F. and H. C. Lampe. The New England Fishing Industry: Functional Markets for Finned Food Fish I and II. Economics of Marine Resources. Paper Nos. 2 and 3. Kingston, R.I.: University of Rhode Island, 1965.

Ferber, R. Statistical Techniques in Market Research. Toronto: McGraw Hill, 1949.

---------, and P. J. Verdoorn. Research Methods in Economics and Business. New York: Macmillan, 1962.

Fisher, R. A. Statistical Methods for Research Workers. 13th. ed. Edinburgh: Oliver and Boyd, 1958.

Fisheries Council of Canada. A brief Concerning A National Fisheries Development Program submitted to Federal-Provincial Conference on Fisheries Development, January 20, 1964. Ottawa: 1964.

Foote, Richard J. "A Comparison of Single and Simultaneous Equation Techniques". Journal of Farm Economics, XXXVII (1955), 975-990.

Fox, Karl A. Econometric Analysis for Public Policy. Ames, Iowa: The Iowa State College Press, 1958.

Frisch, R. Statistical Confluence Analysis by Means of Complete Regression Systems. Oslo: Oslo University Economic Institute, 1934.

Girschick, M. A., and T. Haavelmo. "Statistical Analysis of Demand for Food: Examples of Simultaneous Estimation of Structural Equations". Econometrica, XV (1947), 83 ff.

Güben, H. "Die Elastizitäten der Nachfrage nach Fischen und Fischwaren". Jahres Bericht uber die Deutsche Fisch Wirtschaft, Bonn, Germany: Federal Ministry of Food, Agriculture and Forestry, 1958.

Gordon, H. Scott. "Economic Factors in Catch Fluctuations". Journal of the Fisheries Research Board of Canada, XII (1), 1955.

Gruber, Robert J. Market Study for the Frozen Fish Trades Association Limited. St. John's, Newfoundland: July 1966.

Haavelmo, T. "The Statistical Implications of a System of Simultaneous Equation". Econometrica, XI (1943), 1-12.

Harrington, W. C. "Imported Fish: A Major New England Problem". Commercial Fisheries Review. S: 13-14, February, 1946.

Hicks, J. F. A Revision of Demand Theory. Oxford: Clarendon Press, 1956.

Hildebrant, A. G. U. "Analyse van het Vischverbruik in Nederland". Economisch Statistisch Berichten, (1941).

Holmes, R. A. Estimation of Demand Elasticities for Substitute Foods. Publication No. 3, Agricultural Economics Research Council of Canada, Ottawa: 1966.

Hood, Wm. C. "Empirical Studies in Demand". The Canadian Journal of Economics and Political Science, (1955) 309-27.

---------, and T. C. Koopmans, eds. Studies in Econometric Method. New York: Wiley & Sons, 1950.

Houthakker, H. S. and Lester D. Taylor. Consumer Demand in the United States, 1929-1970, Analyses and Projections. Cambridge, Mass.:

Johnston, J. Econometric Methods. New York: McGraw-Hill, 1963.

Klein, L. R. Econometrics. Englewood Cliffs, N.J.: Prentice-Hall, 1953.

---------. An Introduction to Econometrics. Englewood Cliffs, N.J.: Prentice-Hall, 1962.

Koopmans, T. C. ed. Statistical Inference in Dynamic Economic Models. New York: Wiley & Sons, 1950.

MacKenzie, W. C. "The Demand Outlook for the Canadian Fisheries". Background Papers, Resources for Tomorrow Conference, Vol. 2, Section six. Ottawa: Queen's Printer, 1957.

Manderscheid, Lester V. "Interpreting Measured Demand Elasticities". Journal of Farm Economics, XLVI (1964), 128-136.

Marschak, Jacob. "Money Illusion and Demand Analysis". Review of Economics and Statistics, XXVI (1943), 40-42.

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

Meiken, K.W., A.S. Rojko, and G.A. King. "Measurement of Substitution in Demand from Time Series Data - A Synthesis of Three Approaches." Journal of Farm Economics, XXXVIII (1956), 711-735.

Molson, C.R. and others. An Assessment of the Resource Inventory in Newfoundland Waters, a Report prepared for the Supervisory Committee on Fisheries Development. St. John's, Newfoundland, December 1963.

Nash, Darrel A. "Demand for Fish and Fish Products with Special Reference to New England" in Bell, F.W. and J.E. Hazleton, eds. Recent Developments and Research in Fisheries Economics. Dobbs Ferry, N.Y.: Oceana Publications, 1967.

National Food Survey Committee, as reported in Hamlisch R. and R.A. Taylor, "The Demand for Fish as Human Food". (Paper No. R/V.1/1), Food and Agriculture Organization of the United Nations, International Conference on Fish in Nutrition, Sept. 19-27, 1961.

Nerlove, Marc and William Addison. "Estimation of Long Run Elasticities". Journal of Farm Economics, XI (1958), 861-880.

Organisation for Economic Co-Operation and Development. Price Systems in the Fishing Industry, Paris: 1966.

---------. Financial Support to the Fishing Industry. Paris: 1965.

Organisation for European Economic Co-Operation. Fisheries Policies in Western Europe and North America. Paris: 1960.

Richmond, Samuel B. Statistical Analysis. 2nd ed. New York: The Ronald Press Company, 1964.

Schultz, H. The Theory and Measurement of Demand. Chicago: University of Chicago Press, 1938.

Stigler, G.J. "The Early History of Empirical Studies of Consumer Behaviour". Journal of Political Economy, LXII (1954), 95-113.

---------. Theory of Price. 3rd ed. New York: Macmillan, 1966.

Stone, J.R.N. "The Analysis of Market Demand". Journal of Royal Statistical Society, CVIII (1945), 287-333.

---------. The Measurement of Consumers' Expenditure and Behaviour in the United Kingdom, 1920-1938. Cambridge: University Press, 1954.

Tomek, William G. "Changes in Price Elasticities of Demand for Beef Pork, and Broilers". Journal of Farm Economics, XLVII (1965), 792-802.

Turvey, R. and J. Wiseman. eds. The Economics of Fisheries. (Proceedings of a Round Table organized by the International Economic Association and held in Rome in September 1965). Rome: United Nations, Food and Agriculture Organization, 1957.

Walras, L. Elements of Pure Economics. Translated by William Jaffé. Homewood Ill.: R. D. Irwin Inc., 1954.

Waugh, F. "The Place of Least Squares in Econometrics". Econometrica, XXIX (1961), 392-395.

White, D. J. The New England Fishing Industry. Cambridge, Mass.: The Harvard University Press, 1954.

White Fish Authority. The Future Consumption of White Fish in the United Kingdom. (mimeograph). Hull: England, 1967.

Wold, H., and L. Jureen. Demand Analysis. New York: John Wiley and Sons, 1963.

Working, E. J. Demand for Meat. Chicago, Ill.: University of Chicago Press, 1954.

--------. "What Do Statistical Demand Curves Show?" Quarterly Journal of Economics, Vol. XLI (1927), 212-235, reprinted in American Economics Association Readings in Price Theory. Chicago: Irwin, 1952, 97-118.

Working, H. "New Ideas and Methods for Price Research". Journal of Farm Economics, IX (1961), 68-78.

GOVERNMENT PUBLICATIONS

CANADA

Department of Fisheries and Forestry, Economic Intelligence and Statistics Division Fisheries Service Annual Statistical Review of Canadian Fisheries. Vol. 1, 1953-68. Ottawa: 1969.

Dominion Bureau of Statistics. Fisheries Statistics of Canada, 1950-1966. Cat no. 24-201 Ottawa: D.B.S. for the various years.

--------. Monthly Review of Canadian Fisheries Statistics. Cat no. 24-002. Ottawa: D.B.S. monthly.

--------. Prices and Price Indexes. Cat no. 62-002. Ottawa, D.B.S. monthly.

--------. Trade of Canada: Exports, Volume II: 1950-1966. Cat no. 65-202, Ottawa: D.B.S., for the various years.

--------. Urban Family Food Expenditures 1957, Ottawa: Queen's Printer, 1958.

Frick, H. C. "Urban Family Expenditures of Fish 1953, 1955, and 1957". Trade News of the Department of Fisheries of Canada (March 1961).

Proskie, John. Operations of Modern Longliners and Draggers Atlantic Seaboard, 1952-1958. Primary Industry Studies, No. 1, Bol. 8, Ottawa: Department of Fisheries of Canada, 1960.

--------. Operations of Modern Fishing Craft Atlantic Seaboard, 1959, 1960. Primary Industry Studies, No. 1, Vol. 9 and 10, Ottawa: Department of Fisheries of Canada, 1961 and 1962.

--------. Cost and Earnings of Selected Fishing Enterprises Atlantic Provinces, 1961-1966. Primary Industry Studies, No. 1, Vols 11-16, Ottawa, Department of Fisheries of Canada, various years.

Report of the Royal Commission on Price Spreads of Food Supplies, September 1959. Vol. 2. Ottawa: Queen's Printer, 1960.

Royal Commission on Canada's Economic Prospects. The Commercial Fisheries of Canada. Ottawa: Queen's Printer, 1957.

UNITED STATES

Department of Commerce. Bureau of the Census. Statistical Abstract of the U.S. 1947-69. Washington: Government Printing Office, for the various years.

Bureau of Commercial Fisheries. Fisheries Statistics of the United States 1947-68. Washington: Government Printing Office, for the various years.

--------. Fish Sticks, Fish Portions and Breaded Shrimp. Washington, D.C., for the various years.

---------. Frozen Fishery Products. Washington, D.C., for the various years.

---------. Imports and Exports of Fishery Products. Washington, D.C., for the various years.

---------. Packaged Fishery Products. Washington, D.C., for the various years.

Department of the Interior. Fish and Shellfish Preferences of Household Consumers. Fish and Wildlife Service, Research Report No. 41. Washington: Government Printing Office, 1955.

---------. Household Consumer Preferences for Breaded Shrimp and Breaded Food Sticks. Part 3, Fish and Wildlife Service 1947-1968. Fishery Leaflet 426. Washington: Government Printing Office, 1956.

---------. Report of the Secretary of the Interior to the President and the Congress on The Effects of Imports on the United States Groundfish Industry. Washington, D.C., May 1969.

Department of Labor. Wholesale Prices and Price Indexes 1947-1968. Washington: Bureau of Labor Statistics, for the various years.

---------. Retail Prices of Food 1947-1968. Washington: Bureau of Labor Statistics, for the various years.

---------. Bureau of Employment Security. The Labor Market and Employment Security, 1949-57.

Foote, Richard J. Analytical Tools for Studying Demand and Price Structures. Washington: U.S.D.A. Agricultural Marketing Service, 1958.

Lynch, E. J. and others. The Groundfish Industries of New England and Canada: A Comparative Economic Analysis. Fish and Wildlife Service Circular No. 121. Washington: Department of the Interior, 1961.

Nash, D. A. and F. W. Bell. An Inventory of Demand Equations for Fishery Products. Bureau of Commercial Fisheries Working Paper No. 10. Washington: July 1969.

Norton, V. J. and M. M. Miller. An Economic Study of the Boston Large-Trawler Labor Force. Circular 248, Bureau of Commercial Fisheries. Washington, Department of the Interior, May, 1966.

Tariff Commission. Groundfish Fillets: Report on the Escape Clause Investigation made and published pursuant to the provisions of Section 7 of the Trade Agreement Extension Act of 1951. Report No. 182, second series. Washington: Government Printing Office, 1953.

---. Groundfish Fillets (1954), Report to the President on Escape Clause Investigation No. 25 Under the Provisions of Section 7 of the Trade Agreement Extension Act of 1951. Washington: May, 1954.

---. Groundfish Fillets (1956), Report to the President on Escape Clause Investigation No. 47 Under the Provisions of Section 7 of the Trade Agreements Extension Act of 1951. Washington: October, 1956.

Waugh, Frederick V. Demand and Price Analysis. Economic Research Service, Department of Agriculture, technical bulletin No. 1316, Washington: Government Printing Office, 1964.