become mobile; wholesale houses have sought new centers of distribution and even the processing industry has re-located—it is nearer the new centers of the industry. The chances are that this movement is by no means completed. The importance of some of the old market centers such as the Fulton Fish Market and the French Market in New Orleans are giving way to new price-registering places further inland and also nearer to the centers of production. The rise of the Mexican shrimp fisheries and the discovery of new shrimp beds in Central America suggest that international ramifications of the industry are likely to intensify.

Likewise, the internal structure of the industry which has been shaken loose from its traditional setup is likely to continue to manifest the symptoms of an industry in transition for many years to come. New forms of fishing have called for new forms of fishing organization. Gradually fisheries become both larger in scale of operation and larger in their capital structure. The ties between processors, wholesalers, and boat owners have become both more complicated and more integrated. The movement to larger concentration has been accompanied by the counter action of larger specialization. The fresh product, the frozen product, and the canned product tend to seek their own specialized ways of production and channels of distribution. At the consumer end the product is meeting with new competition of such products as fish sticks and other frozen foods.

Last, but not least, the fisherman himself finds that he is pulled out of his old way of living into new modes of bread-winning activity. The unions have become an important factor in some shrimp fishing areas. The higher development of fishing technology, the lengthening of fishing trips and the shifts in fishing bases have added new risks for the fisherman and have caused more exacting demands on his skills and capabilities. While financial rewards to the fisherman have tended to increase, the economic insecurity has not been substantially lessened. Boat owners likewise have been benefited by the rise of financial returns, but are faced with new problems in stabilizing their operations by better methods of management, new forms of marketing and sounder financial methods. Wholesalers have been exposed to the pressures of rapidly changing markets, fast depreciation and obsolescence of assets and financial risks in seasonal and cyclical market fluctuations.

As we look at the picture of shrimp fisheries as a whole, we see that the past years have vastly increased the total potential of the industry, offering the lures of a steadily growing consumer demand and rising production, but also threatening the industry with the tremendous impact of revolutionary changes in technology, production, marketing, and finances, and it is presenting to the industry a challenge of vigilance and financial preparedness.

The Post-War Demand For Fishery Products With Special Reference to Shrimp and Oysters

GEORGE M. WOODWARD

University of North Carolina,
Chapel Hill, N.C.

DURING THE PAST 25 YEARS the fisheries of the United States have shown little evidence of growth other than that required to supply a relatively stable per

capita consumption of the products of the seas, and in general have exhibited a pattern of economic behavior quite similar to that of the economy as a whole. For an explanation of these phenomena we must look mainly to the science of economics rather than to biology. In recent years the volume of the total catch itself has varied closely with the concomitant changes in two economic variables, the average price per pound of fish and the annual value produced per fisherman. This is not to say that these two magnitudes cause the changes in the volume of the catch but the high degree of correlation between the three variables points to the importance of economic forces. In addition the fluctuations in both the "national income" generated by the fisheries and the value of the total fish catch follow rather closely the changes in the national income of the nation as a whole.

The history of the per capita consumption of fishery products is largely one of a stable level of from 10-12 pounds a year, interrupted by depression and war. The consumption per person was 10.5 pounds in 1930; this figure fell to 8.9 in 1932 and then rose steadily to 12 in 1936. The 1935-39 average was 11.1 pounds. The ordinary use of fishery products declined during the war because of the unusually large canned fish purchases for use by the military and for export to allied nations, but by 1946 the prewar consumption level had been approximately regained. Since that time the per capita figure has varied between 10.8 and 11.5 pounds. In 1954, it was 11.1, the same as the 1935-39 average. This is in contrast to the consumption of about 153 pounds of red meat in 1954, an increase of 22 per cent over the 1935-39 average of 125, and the growing consumption of other protein foods such as poultry and dairy products. While the difficulty of accounting for tastes or changes in tastes has become proverbial, attention may be called in passing to certain reasons for the failure of the per capita consumption of fish to follow the same trend as that of other important protein items. Two such reasons are the inability, or at least the failure up to the present, of the industry to set any standard grades for fishery products and the difficulty, due largely to extreme perishability, of maintaining consistently high levels of quality.

As has been noted before, the fluctuations in the national income generated by the fisheries follow rather closely the changes in the total national income (Figure 1). During the war years of 1941 through 1944 the national income which originated in the fisheries lagged somewhat behind the growth in total national income, however. This was true in spite of the fact that the growth in the value of the total catch of fish was almost exactly at the same rate as the increase in the aggregate income figure. The explanation lies in the fact that the terms of trade, that is, the relationship between the costs of what they buy compared with the prices received for what they sell, turned against the fisheries slightly during the period in question. This change was due almost entirely to the increases in costs, both absolute and relative, of food, fuel, ice, boat supplies, repairs, maintenance, and gear that the fisheries purchase from other industries. The costs of such items increased to as high as 47 per cent of the value of the catch in 1943, whereas they averaged only about 37 per cent before the war.

Between the end of 1944 and the end of 1949 the value of the aggregate catch of fish increased much more than the total national income, without any marked change in volume or composition of the catch. At least a partial explanation of this fortunate turn of events may be found in the relationship between fish prices and meat prices. After the end of the war the ratio of fish

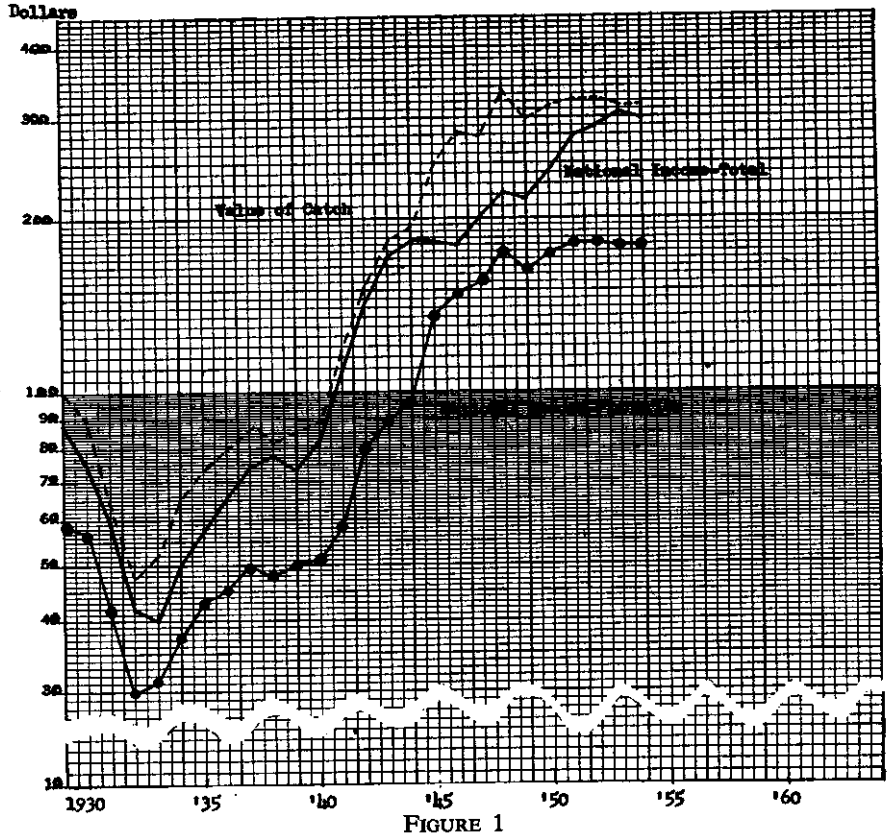

FIGURE 1

prices to meat prices declined markedly (Table 1). In other words, during the postwar period the prices of fishery products advanced, but not as fast as the prices of meats, so that there was probably some substitution by consumers of the former for the latter. The shortages of meat at the artificially held low prices during the war may also have been another factor affecting the consuming habits of the public in the direction of increasing the demand for fish. After the end of the war, also, the terms of trade turned back in favor of the fishermen, in that the cost of purchases from other industries became a smaller percentage of the total value of the catch. As the result of all of these factors the part of the national income generated by the fisheries gained relative to the totals for the entire economy (Figure 1).

These same phenomena are reflected in the average income per person of the proprietors and employees in the fishing industry as compared with that of these same groups in the economy as a whole (Figure 2). During the war the increases in the incomes of the fishery people lagged behind those of proprietors and employees in general, but during the postwar boom the relative position of the former improved until it was somewhat better than before the war. Although it is still too early to assess all of the forces at work, the fact that in the last two or three years the relative position of the fisheries has deteriorated somewhat may be attributable to the operation of economic forces

TABLE I

INDEX OF RETAIL PRICES OF FISH, MEAT, AND ALL FOODS, AND FISH/MEAT PRICE RATIO U.S. 1939-1953 (1935-39 = 100)

Year	*Fish*	*Meat*	*All Foods*	*Ratio Fish / Meat*
1939	101.0	96.6	95.2	105.1
1940	110.6	94.4	96.6	118.0
1941	124.5	106.5	105.5	116.8
1942	163.0	122.5	123.9	133.0
1943	206.5	124.2	138.0	166.2
1944	207.6	117.9	136.1	175.9
1945	217.1	118.0	139.1	183.8
1946	236.2	150.8	159.6	149.0
1947	271.4	214.7	193.8	126.2
1948	312.8	243.9	210.2	128.2
1949	314.1	229.3	201.9	137.0
1950	308.5	242.0	204.5	127.5
1951	352.0	274.6	227.4	128.2
1952	344.2	273.6	231.4	125.8
1953	328.2	258.7	230.0	126.9

Source: U.S. Department of Labor, Bureau of Labor Statistics.

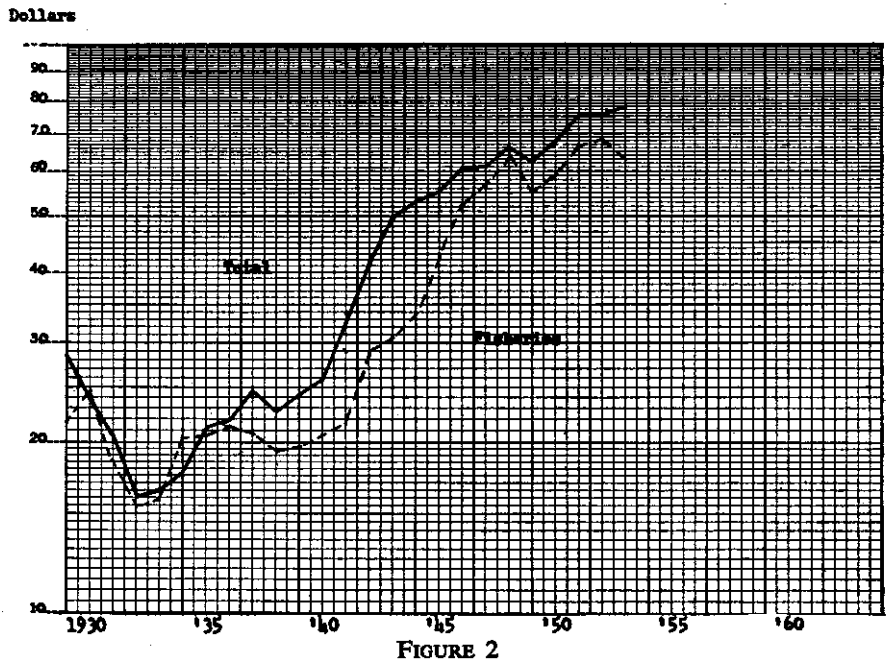

FIGURE 2

to cause a return of the fishing industry to its pre-war relative position. Other factors working toward this same end may be the decline in meat prices since 1951 and the growth of imports of fishery products. In any event, by 1953 the income elasticity in value terms of the demand for fish (increase in the total amount of money spent for the item as compared with the increase in total disposable income) had become slightly lower than that for food in general and for meat, after being consistently higher than that for the other two types of food during the previous post-war period. Looking at these matters in a different way it can be said that over the years, in spite of all the dislocations of depression and prosperity, war and peace, economic forces operated to allocate sufficient economic resources to the fisheries to produce the quantity of product that could be sold at prices which would keep the chief recipients of income in the industry, the proprietors and employees, in approximately a constant position with respect to real income relative to the economy as a whole. From a biological point of view it is interesting to note that over the years economic resources have been attracted to the industry without any clearly discernible declining trend in physical productivity per fisherman.

If the type of analysis sketched here in broad outline is valid, two practical conclusions logically follow.

(1) There is as much need for economic research pertaining to the fisheries as there is for biological research; and

(2) If the rate of growth of the fisheries industry is to be increased, considerably more resources will have to be devoted to demand-creating promotional activities than in the past.

For a number of reasons it is interesting and informative to analyze the postwar demand for oysters and shrimp against this general background of economic conditions in the fisheries as a whole. Both of these items have shown a favorable income elasticity of demand relative to that for other foods in recent years and of course the increases in the demand for shrimp have been little short of sensational. The oyster, moreover, is more subject to production control by man than most marine species, and perhaps is potentially important as a product of South Atlantic and Gulf fisheries. Shrimp, of course, is currently the most valuable single marine product of the South as well as of the nation as a whole.

The long term trend in the production of oysters has been definitely downward. This is true in spite of increasing population and improving standards of living in this country, and is in rather sharp contrast to the trend in the production of red meat (beef, pork, veal, lamb, and mutton). Oyster production declined from about 108 million pounds in 1920 to about 66 million in 1950, while meat output increased from approximately 15 billion pounds to 22 billions over the same period. The decreases in the oyster harvest have occurred at the rate of about 1.5 per cent a year on the average during the period since 1920, and the deviations from this average were fairly great only during the worst years of the depression of the 1930's.

There is fairly strong evidence that this long term trend is a reflection of a gradual but steadily lessening demand for oysters prior to World War II. In that period the reduced production had not forced prices up significantly as would have been the case if demand had remained approximately the same.

After the entry of this country into World War II a whole new set of economic forces came into play.

It is not possible to assign any definite reasons for the slackening in demand for oysters between 1920 and 1940. It is probably true that biological scarcity or natural depletion of supply is not sufficient alone to explain the decline in the consumption of oysters, although it should be pointed out that absolute shortages or difficulty in obtaining an economic good may cause consumers to become weaned away from it. Similarly, it may be argued that the high costs of production, especially labor costs, due to the inability of the industry to mechanize, may reflect back through high prices not only to reduce the amount of the product purchased immediately but also, from lessened use, may change the habits and tastes of the consumers. In other words, in some cases supply factors and demand factors are interacting, and a reduction in supply for whatever reason may in turn react to reduce demand. Another way in which supply factors may have affected demand is that the preoccupation with production problems which has prevailed in the industry in recent years may have reduced the amount of selling effort exerted. In many cases it has been relatively easy to sell the limited supplies available at acceptable prices without vigorous selling efforts.

Other speculative reasons for the probable downward trend in demand are: increased competition from shrimp, crabmeat, and lobster for the cocktail and society trade; replacement of *table d'hote* menus by *a la carte* menus in the better restaurants; the harm which typhoid scares of the 1920's did to oyster sales; and the growing popularity of other "snack" items, such as the hamburger and the hot dog. The demand for oysters as an item of diet is based largely upon their distinctive flavor and the opportunity they afford for variety, since they are not an economic source of animal proteins. It is true that the oyster is a balanced food in the sense that it contains all three types of foodstuffs, carbohydrates, protein, and fat, but it has less than half of both the caloric value and the protein content of beef (380 compared with 919 calories to the pound and nine or ten per cent protein against about 21 per cent). The oyster, moreover, has always been a rather high-priced food item, the taste for which is probably acquired.

Statistical investigations have shown that in the short run the price of oysters per pound of meats received by the fisherman in the postwar period is determined mainly by three factors: volume of production of oysters, the size of the total national disposable personal income (personal income after income taxes) and the price of meat as measured by the Bureau of Labor Statistics Meat Price Index. As might be expected, the greater the production of oysters the lower the price to the fishermen, but the greater the personal income and the price of meat the higher the oyster price.

One of the most important practical aspects of the nature of the demand for oysters is the relationship between the prices so determined and the quantities that can be sold at various prices. This is what is called the price elasticity of demand in economics. Several statistical analyses of different types have indicated that this elasticity in the case of oysters is less than unity. What this means is that if oyster prices decline the additional quantity that could be sold at the lower price would not be great enough to offset the decline in revenue per unit of sales and that the total dollar receipts of sellers at the reduced prices would be lower than before. Or, looking at the matter in a slightly different way, this means that if the oyster industry is to sell sig-

nificantly larger quantities of the product than at present on the basis solely of price competition for the consumer's dollar it will have to cut prices and costs rather drastically.

The long term downward trend in demand for and production of oysters seems to have been at least interrupted by World War II, especially during the period from 1942 to 1947 or 1948. The relative shortage at the artificially held ceiling prices of meat and other protein foods and the rationing of many of these items gave a fillip to the demand for fishery products in general and for oysters in particular. Some of this increase in demand for this relatively expensive product seems to be holding in the prosperous postwar period. The income elasticity of demand for oysters in value terms over the period from 1940 to 1952 is greater than that for food in general, for meat, and for fish in general, and is exceeded only by that for shrimp among closely competing products.

There has been at least a potential threat to this somewhat improved position of the oyster fishery since 1952, however, in that the competitive position of oysters with respect to prices, especially as compared with those for red meat, poultry, and fish, has worsened significantly. The Bureau of Labor Statistics price index number for oysters was 10 to 15 points higher than the corresponding combined index for meat, poultry, and fish during most of 1953 and 1954 after being lower than the latter through most of 1950.

The practical implication of all these facts is that if the oyster industry is to grow significantly something must happen, or be done, to increase the level of demand or costs of production and selling prices must be substantially reduced, or both. The best opportunity for reduction in costs lies in increasing the productivity of the oyster beds since the labor and indirect costs of production are determined largely independently of the industry itself, and are thus substantially fixed at any given time. While the productivity of the beds may be largely a matter of the technology and biology of oyster growth, consideration of the costs of producing shell stock involves also the factor of public policy as it can be shown both theoretically and empirically that the greatest value of product per unit of economic resources can be produced under a system of private property.

A private enterpriser who owns a plot of oyster bottom of, say, superior productivity would, of course, want to determine the optimum number of units of productive effort to be expended upon the resource. He would tend to increase productive effort up to the point at which an additional unit of effort would increase his income by no more than the cost of the extra productive unit. Or, in the technical language of economics, he would equate his marginal cost and his marginal revenue. In so doing he would maximize the "economic rent" or surplus of product over and above what inferior grounds would yield. Also, of course, he would realize an average return per unit of productive effort expended greater than the average cost of such units, or a profit over and above all costs, including a normal return on capital invested, and all wages including wages of management.

Under the institution of common ownership, on the other hand, oystermen tend to exploit the superior bottom first or more intensively than the others until its average productivity is reduced to equality with that of the next best ground. This process continues, theoretically, until the average productivity of all the plots has been reduced to equality. Competition among the fishermen would force this point of equality down until the returns just barely covered

the total costs of production. Thus the additional income possible under the institution of private property is dissipated under the system of common ownership. What is more, since under the latter there are no costs of growing oysters to the individual oysterman, there is nothing of an economic nature to prevent the fishermen from stripping the beds to such an extent that they cannot replace themselves. And of course no one has any incentive to plant or cultivate oysters, for he could not appropriate the harvest.

The empirical evidence in favor of private cultivation in the oyster industry is perhaps even more impressive than the theoretical. According to Galtsoff (1943), "The total acreage of oyster bottoms in our coastal waters can be estimated only approximately. According to present computations there are in the territorial waters of the United States about 1,428,400 acres officially designated as oyster producing bottoms. A small proportion of this area, not exceeding 185,000 acres of privately-leased or owned bottoms, produces 54.5 per cent of the total oyster crop. There is, thus, a very great difference in the productivity of cultivated and natural oyster beds."[1]

Such evidence of superior productivity could be multiplied many fold, but time prevents the citation of other cases.

The dynamic changes in the shrimp fishery of the United States have been so rapid and of such magnitude that a comprehensive, definitive, quantitative analysis of the industry as a whole is extremely difficult at this time. However, it may be possible to make certain useful observations and draw some meaningful inferences from the information available.

In contrast to the case of the oyster, both the domestic catch and the total supply of shrimp available for consumption have increased without serious interruption during the past 25 years at an average rate of about 5 per cent a year. During this period the industry has had a notable history of improvements in boats and gear and in production and handling technology generally. These developments were accompanied, of course, by numerous discoveries and subsequent exploitation of new shrimping grounds. An index of the increasing allocation of economic resources to the industry is to be found in the number of shrimp boats in existence—about 1700 in 1932 and over seven thousand in 1952—to say nothing of the growth of the size and value of these craft.

Although the production accomplishments of the industry have been truly dramatic, the really spectacular thing about shrimp has been the increase in demand. In spite of the expansion in supplies available, the level of demand has grown so rapidly that ex-vessel shrimp prices have increased more rapidly during the past twenty or twenty-five years than those of consumer goods in general, of food or fish in general, or of meat or oysters. These increases between 1932 and 1952 were, for example, shrimp—1065 per cent; oysters—469 per cent; fish—337 per cent; food—268 per cent; consumers' goods—194 per cent. Similarly the income elasticity of demand for shrimp in value terms has exceeded that of the other types of goods over this same period.

The increases in demand for shrimp have been associated with the growth in consumer purchasing power, social and institutional changes which have greatly increased the consumption of food away from home, and improvements in technology which have made fresh or frozen shrimp widely available

[1]Galtsoff, Paul, *Increasing the Production of Oysters and Other Shellfish in the United States* (Chicago: United States Department of the Interior, Fish and Wildlife Service, 1943.) Fishery Leaflet 22.

in consumer markets. Since shrimp is a relatively high priced food item, the growth in per capita real income in recent years was at least a permissive factor in the growth of demand. Until recently, moreover, the great bulk of the shrimp consumed was eaten in restaurants or other non-private establishments. The restaurant trade has done an excellent selling job on the product and this fact coupled with the changes in American life which have increased the practice of "eating out" has been another contributing factor to the growth in demand. There are no exact data available on the number of restaurant meals served or the volume of food consumed outside the home, but an index of such quantities constructed from the total expenditures on purchased meals adjusted for food costs shows an increase since 1935 much greater than that of the population of the country. The trend toward frozen shrimp has also contributed to the growth in demand in that it has made a quality product widely available in inland markets throughout the nation. The percentage of the total supply of shrimp utilized in this form has about doubled since 1945 and now makes up well over one-half of the total.

The importance of this tremendous growth of demand in relation to the production of shrimp is evidenced by the fact that while the production in pounds per productive unit in 1952 was only about 65 per cent of what it was in 1940 the value produced per unit was more than three times as great. In other words the industry continued to expand in spite of the diminishing catch per boat in recent years because the *value* of the catch per boat did not decrease.

The very rapid growth in the level of demand for shrimp has tended to obscure the normal relationship between prices and the quantities which could be sold at the various prices, i.e., the price elasticity of demand has been overshadowed by the almost continuous upward shift in the quantities that could be sold at all relevant prices. This fact makes the statistically determined demand and supply functions expressing relationships between prices and quantities unsatisfactory for some purposes. The tentative estimates that have been made from the demand functions calculated, however, indicate that while the price elasticity of demand for shrimp probably is greater than for oysters, it is still less than unity.

If this is true and if the general level of demand should stop rising, many of the implications of the inelastic demand for oysters might become relevant to the shrimp fishery. In a sense shrimp has been a new product—and perhaps still is—which has been in the process of being spread out over the entire limits of the potential market, both geographical and institutional. It would appear that now these limits are being at least approached and when they are reached, the industry will have to think in terms of marked cost and price reductions as the requirements for further expansion. Moreover, the extent to which the market limits can be pushed back will depend in an important way upon how much the home consumption of shrimp can be increased in the next few years. In this connection costs and prices will be significant factors along with the quality and convenience characteristics of the product.