

The Effect of Reduced Supply on Fish Processing in New England

Daniel Georgianna, Professor of Economics, UMass Dartmouth
Joel Dirlam, Professor Emeritus, University of Rhode Island

Abstract. Due to declines in stocks, restrictive management plans, and imports of whole groundfish from Canada, the supply of whole fresh Atlantic groundfish to New England processing plants (landings plus whole fresh imports) declined by 75% since its peak in 1983. These reductions in supply of Atlantic groundfish put severe pressure on New England fresh fish processors. Survival techniques, including scouring local ports, Canada, and the West Coast for whole groundfish, importing fresh fillets, exploiting niches, substituting for groundfish, focusing more on wholesaling, and closely watching the bottom line, favored Boston processors, because they have advantages in transport costs, easier access to the regional food processing market, and share in the cost economies from brokerage, packing, transport, and wholesaling activities that support processing. As the smaller firms have turned to wholesaling or simply vanished, there are fewer, and typically larger firms. Large firms are better able to draw on widely scattered geographic sources, and adapt to display auctions, now an indispensable source of domestic whole fish. The forces that are reshaping the structure of the processing industry are, therefore, real economies of scale. While the high levels of the concentration might seem to convey substantial market power to large processors, the pressure on margins that has accompanied the falling supply has effectively prevented concentration from leading to non-competitive prices and profits. Many of the changes in structure of groundfish processing due to supply shortages will probably not be affected by increases in landings, when and if stocks recover. Production of frozen fish products declined more than fresh fish production due to falling demand for frozen products.

Keywords: Fish processing, fishery management, industrial structure, market power.

INTRODUCTION

Fresh fish processing and frozen fish processing are two separate industries in New England, each with its own customers, firms, and industrial organizations. While both face declining revenues, each has been subject to quite different market pressures.

Fresh fish processors buy whole fresh supplies from fishermen locally and at other New England ports, and they bring in fresh supplies from other parts of the US, from Canada and from other countries. They process the product (for example, cutting fish into fillets) and sell these products to wholesalers, retailers, restaurants, and other final users. When landings were plentiful in the past, most processing firms specialized in specific products, although a few firms, mostly in Boston and New Bedford, processed a wider assortment of fishery products to serve as a kind of one-stop shopping point for their customers.

Supply of fresh fishery products is highly volatile because most fish and shellfish are essentially captured in the wild. Farmed fishery products, a much smaller source of supply, are also subject to far more variability than domestic livestock, fruit, or vegetables. Prices that processors pay at the dock and the prices they receive for their products, therefore, vary daily and sometimes hourly. Haggling defines the fresh fish business.

The fish business is also risky. Fresh fishery products are marketed under extreme time pressure and with

incomplete information. Fresh fishery products must be sold within a week to 10 days to final users, who are very concerned about product quality. Yet wholesalers and others who buy from processors do not generally know product quality because most sales are made over the telephone and the product arrives after the sale has been agreed on. Buyers take serious risks with their suppliers, and expect high-quality product delivered on time.

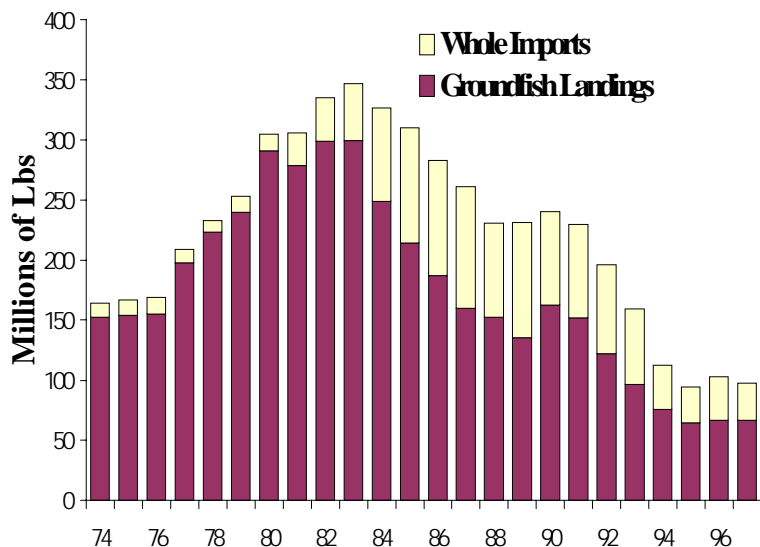
Processors and wholesalers selling in this market also take risks with their customers because they can't reclaim the product for bad debts. To avoid risk, customer loyalty developed between fresh fish processors, their suppliers, and their buyers. Product quality and financial responsibility set the ties that bind fresh fish processors to their good customers and vice versa.

Few fresh groundfish processors produce frozen product, and those that do sell special orders to institutions, usually government agencies, who are sometimes required to purchase U.S. product. Frozen groundfish processors buy frozen inputs, which are imported into the United States from Canada, Iceland, Norway, and from around the world. These frozen inputs, mostly frozen blocks of fillets, are processed into frozen portions, sticks, and other products for sale to supermarkets, restaurants, and institutions. Frozen products keep for a long time and are not subject to the same time constraints as fresh products. Prices are less volatile, markets more impersonal, and business relations

more competitive. Frozen groundfish plants are also much larger than fresh groundfish plants, and they operate longer through the day and through the year.

REDUCED SUPPLY OF GROUND FISH

Fresh fish processors in New England find their supply of groundfish from New England landings, whole groundfish imports from Canada, and fresh and frozen whole groundfish from the West Coast. Except for a modest recovery in the early 1990's, groundfish landings in New England have declined continuously since their peak in 1983 (Figure 1). Landings increased sharply following the extension of the



exclusive fishing zone in 1976, but by 1997, New England landings were less than half of what they were in 1976, before the EFZ.

Figure 1. Supply of fresh groundfish to New England.
(Source: NMFS)

Imports of whole groundfish from Canada mitigated the decline in groundfish supply to New England processors during the 1980's, but this source of supply began to dry up after 1993. In 1991, Canada closed the Grand Banks, once the richest cod grounds in the world, to fishing for cod, and it has not allowed commercial fishing for cod since. Landings in Newfoundland from the Grand Banks were mainly processed into frozen blocks, and landings in Nova Scotia, not from the Grand Banks, had been chief source of whole fresh groundfish to New England. Higher prices for fresh fillets and a U.S. countervailing duty on whole groundfish imports from Canada had led Nova Scotia processors to export fresh fillets rather than whole fish to the U.S.

When their Canadian supply declined, New England processors substituted some whole fish imports from Iceland, but most of the increase in imports from Iceland into the U.S. was in the form of fresh fillets. Fresh groundfish fillets

imported from Iceland have largely replaced imports from Canada. Iceland Air flies directly from Iceland to Boston, carrying 2 million lbs. of fresh fillets in 1997 (Wall Street Journal, 3/11/98). Between 1990 and 1997, imported fresh fillets from Iceland increased from 3 million lbs. to 8 million lbs., while fresh fillet imports from Canada dropped from 20 million lbs. to 4 million lbs. (Georgianna and Dirlam, 1999). Fillet imports do not, of course, necessarily flow to processors; they may also be imported by wholesalers.

New England processors told us in a series of interviews conducted in 1997-1998 that whole Pacific cod was coming into New England, mostly into Boston, from the U.S. West Coast. Some of it was frozen and then thawed or refreshed and cut into groundfish fillets for East Coast markets. There are no data on movements of groundfish products within the U.S., but the smaller decline in New England fresh fillet production than in New England and Canadian whole groundfish supply supports the observation that New England processors have substituted Pacific cod for Atlantic groundfish.

DECLINE OF FRESH FISH PROCESSING

The expansion of the fishing industry that followed the 200-mile limit carried over into the fresh fish processing industry. Established firms in Boston, New Bedford, and Gloucester hired fish cutters, trimmers, packers, and other specialized tradespeople, and they paid good wages to prepare fresh fillets for the market. New firms sprang up in these ports, and in the smaller ports, especially on Cape Cod, new firms and fishing cooperatives tried their hand at cutting and marketing fresh fillets. Fresh fish was available on the docks, and fresh product was easy to sell to health-conscious consumers at high prices. Fishermen increased their catch of other products such as sea scallops, which are almost always shucked at sea, other high-valued species, such as lobster, and even lesser-valued products like herring and squid. Shoreside processors bought and processed or simply repackaged whatever fishermen landed and quickly sold the products on the wholesale market for high prices. Business was good.

When fishing began its downward spiral in the early 1980's, the fresh fish processing sector followed. Rising prices pushed revenues higher but not for long because higher prices increased consumer demand for substitute products. Prices for fishery products were limited by the prices of these substitutes.

The value of fresh processed products in New England reached its peak in 1986 at \$300 million, but fell to \$215 million by 1995, before recovering somewhat to \$240 million in 1997. Adjusting these values for inflation by converting to 1997 dollars shows a more dramatic decline. The real value of fresh product fell by nearly 50 percent from its peak in 1986 (Figure 2). Almost all the decline in fresh product value was in fresh fillets caused by the collapse of groundfish landings in New England.

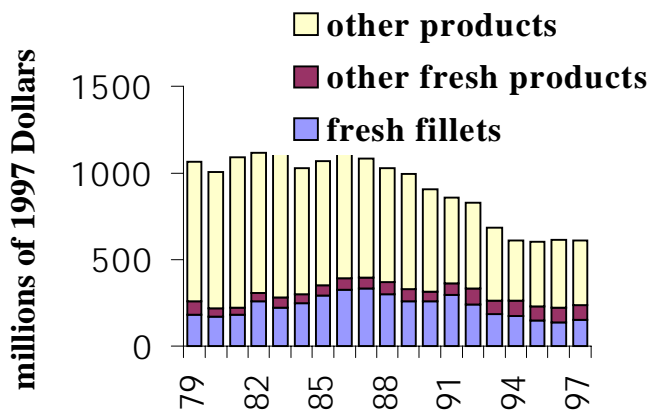


Figure 2. Value of New England processed fish products
(Source: NMFS)

Some firms have found it impossible to continue in business in the face of this drastic decline in supply of raw material and production. They liquidated. More than one-third of the firms in business in 1992 have since left (Figure 3). Surviving firms adopted a wide assortment of strategies to stay in business. Fish processing and wholesaling firms—family businesses for several generations, with established goodwill and experience in meeting crises—were not likely to exit

Surviving processors intensified their buying within New England, to ensure that they maintained at least their share of the dwindling landings. They went farther afield from their home port to establish new buying relationships. Processors adjusted their purchasing to the marketing innovation of display auctions that were recently established in New Bedford and Gloucester. These auctions were modeled on the Portland Fish Exchange, which had successfully modernized Maine’s fishing industry a few years before. As supply continued to shrink, the surviving processors scoured the smaller ports for product, buying wherever they could, often in very small lots.

In addition, surviving processors imported more whole and processed fish. Canada, however, the traditional supplier of groundfish to the United States, had also suffered a sharp decline in landings. As noted in the previous section, shipments of whole Pacific cod to Boston probably reduced the shortage of whole groundfish to New England processors, but the higher prices for groundfish fillets also drew competitors into the fresh fillet market, mainly from Iceland and Canada.

Because they couldn’t find enough traditional products to satisfy their customers, processors switched to different species and products before local fishermen did.

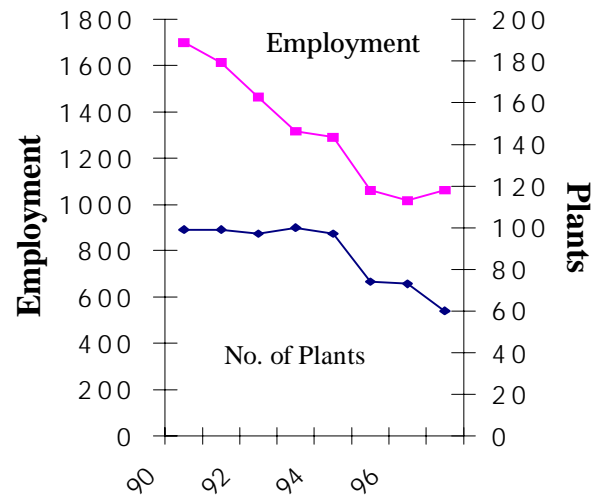


Figure 3. Fresh fish processing employment and number of plants in New England.
(Source: NMFS, DET)

They persuaded their customers to buy substitutes, even though New England consumers in particular were reputed to have an indissoluble attachment to traditional species. Processors and wholesalers imported farmed salmon, shark, tilapia, mahi mahi, and orange roughy, and they brought products from other parts of the country, such as catfish from the South, to supply restaurants and retail fish counters in New England and elsewhere.

Some fresh fish processors exploited niches such as selling high-quality product directly to customers for special events, such as catered business cocktail parties, promotions, trade shows, and even private parties. Some processors stopped cutting fillets in order to save expenses and concentrated instead on using their business contacts and inside information to wholesale products without processing them.

All surviving processors paid more attention to the bottom line. Shortage of supply of raw material intensified competition in buying whole groundfish among fresh groundfish processors. Other costs also increased. Substantial new investment in both equipment and training was necessary to conform to new health regulations. Final demand prices at the retail level, however, didn’t rise as much because competition from substitutes like chicken severely limited price increases for fishery products. Supermarkets improved their handling and marketing of fresh fish products, attracting customers rebelling against higher prices in specialized fish markets. Dozens of small fish markets went out of business. Processors sold less product to fish markets,

where they had developed personal relations, sometimes over several generations, and more product to supermarkets, which operated on narrow margins of their own and traditionally drove hard bargains with their suppliers.)

Most of these survival strategies favored Boston firms. Access to Logan Airport and access to the New England regional food wholesaling system in Boston gave them an advantage over processing firms in other ports. Access to raw material gave other ports an advantage during the boom in landings, but this advantage has disappeared with the decline in landings. New Bedford processors, who used to truck whole fish into the city from other ports, now process only the fish that is landed locally. Processors in Gloucester and other Massachusetts ports now process fillets for local customers and ship the rest whole to Boston for processing.

DECLINE OF FROZEN FISH PROCESSING

As with fresh groundfish processors, frozen groundfish processors suffered a shortage of supply. Before 1991, most cod frozen blocks, the raw material for most frozen groundfish products were imported from Canada. Following the decline of Canadian landings after the closure of the Grand Banks to cod fishing in 1991, imports of cod blocks to the U.S. decline sharply (Figure 4). As cod block imports were declining, U.S. imports of pollock blocks were increasing as rapidly as cod block imports were declining. After declining sharply in the early 1990's, total imports of frozen blocks have recovered. By 1998, imported groundfish blocks were about 85 percent of their total in 1990 (Fisheries of the U.S.).

The import data implies substitution between cod and pollock blocks, due to the scarcity of cod and the abundance of pollock, especially from Russia, which has a large fleet and almost desperate need for hard currency.

There is little direct evidence, however, of substitution of pollock for cod, because pollock has different qualities from cod, including taste and texture. Industry sources, however, told us that large producers of breaded cooked fillets, portions, and nuggets have almost completely replaced cod with pollock in 1996 and 1997. Most U.S. production of pollock block seems to go into surimi, which is now widely sold in supermarkets throughout the U.S.

Frozen fish processors located mostly in Gloucester and New Bedford, however, faced a different set of problems than the declining supply that checked fresh fish processors. Consumer demand for fish sticks and portions, the major products of this sector, has been declining since mid-1980, driving down production and prices. The combination of falling production and prices caused a sharp drop in revenues. Actual revenues for frozen fishery products processed in Massachusetts dropped more than 50 percent from their peak in 1986. After accounting for inflation, frozen processed product sales dropped by more than 60 percent (Figure 2). Fish canneries left Massachusetts long ago.

Upscale frozen and freeze-dried products for easy preparation in microwave ovens have never fulfilled their promise in the United States. Long a high value-added product in Northern Europe for households where

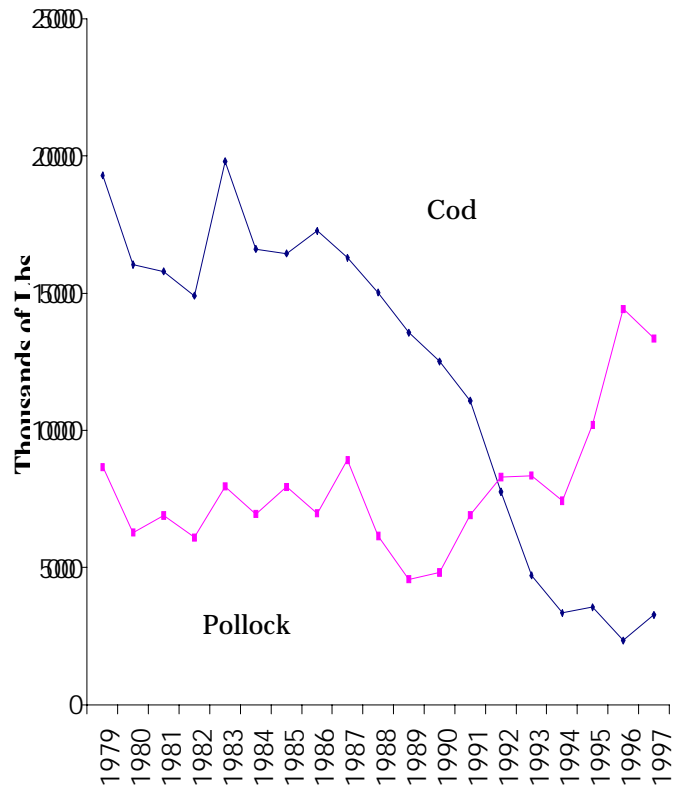


Figure 4. Imports of Cod and Pollock Blocks to the U.S. (Source: Fisheries of the United States, NMFS)

almost all women work outside the home compared to about 60% of women in the U.S. who are in the labor force, these products have never caught on here. Increasing value-added through better product remains the main hope for an industry where the source of supply is declining, but raising prices for higher quality has rarely worked in any sector of the U.S. fishing industry.

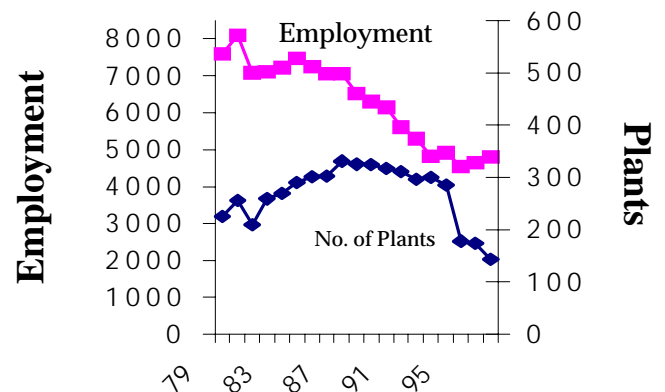


Figure 5. Fish processing employment and number of plants in New England.

(Source: Fisheries of the United States, NMFS)

While we were not able to separate frozen fish processors from other fish processors due to the wide assortment of frozen and fresh product, data on fish processing plants in New England support the hypothesis that employment and the number of frozen fish processing plants have declined (Figure 5). The number of plants, relatively stable through the 1980's and early 1990's, dropped sharply after 1994. Employment has declined steadily through the 1980's and 1990's.

Stability of Wholesaling

As stated earlier, many processing firms seemed to have abandoned the processing side of their business to concentrate on wholesaling because they could still trade on their contacts with buyers, supplying them with product that they purchased from other processors. The increase in imports of traditional products and imports of a wide assortment of new products also offered profit potential to existing wholesalers and those firms that shifted from processing to wholesaling. The number of wholesale firms in New England have increased steadily from less than 400 in 1982 to over 600 in 1997 (Figure 6.). Employment has remained roughly constant at around 4,500 people, except for a large, unexplained drop in 1991.

The surprising growth in wholesaling may be reversed if Internet marketing, still in its infancy, is increasingly used to bring processors and customers together. Small processors may benefit, but wholesalers will be hurt. By consolidations and acquisitions, processors and customers join forces, or, as in case of Legal Seafood, the customer owns processor plants. Large international producer-marketers have trespassed conventional channels of distribution and now bypass importers, brokers, wholesalers, distributors and freight forwarders.

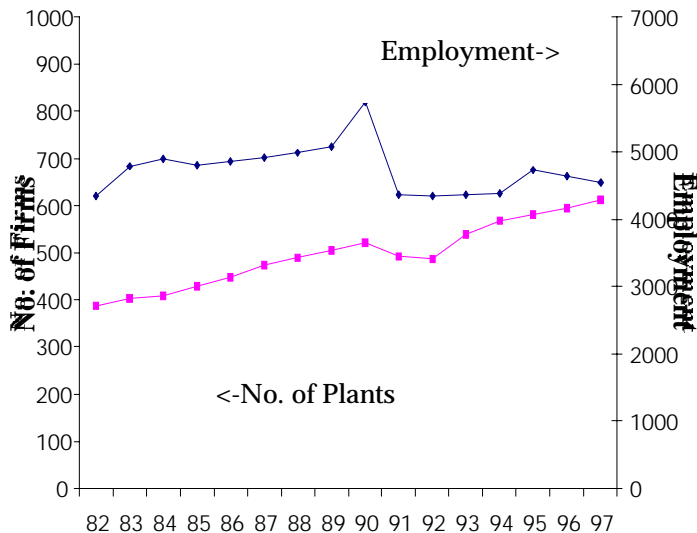


Figure 6. Fish processing employment and number of plants in New England.
(Source: NMFS, DET)

ELEMENTS OF MARKET STRUCTURE

Where the number of competing firms is large, the power of any one of them to act independently on either the buying or selling side of the market may be limited. When there are only a few sellers, however, they may find it easier to collude, or a dominant firm may take the initiative, in raising or lowering a prevailing product price. A few large buyers at a display auction, for instance, might find it easier to arrive at tacit or overt agreements for the allocation of lots before the bidding begins, in order to moderate or avoid vigorous

Competition (Figure 6). And competition in an industry dominated by a few large firms, where each firm is familiar with its competitors' product and price strategies is far removed from that encountered in typical commodity markets.

The extent to which a given market, in this instance processed groundfish, may be subject to oligopoly or monopoly power, is customarily determined by examining three major elements of market structure: concentration, distribution among firms of market shares, and ease or difficulty of entry of new firms. These measures can be useful, however, only when they are applied to relevant markets. The Antitrust Division and the Federal Trade Commission have adopted guidelines that rely on measures of substitutability among products and between locations to isolate markets wherein they can determine the degree of monopoly power or the presence of effective competition. We need to know, therefore, whether New England can be regarded as an economically distinct geographic market, and fresh and frozen products as separately distinct products, before attempting to apply the market structure test.

New England as a geographic market

There are, unfortunately, few if any quantitative data about the extent to which processed groundfish is shipped into or out of New England. Nevertheless, the processors' historical dependence on regional landings and imports of whole groundfish and fresh and frozen fillets from Canada's Atlantic provinces, the absence of significant numbers of processors of groundfish in states outside New England, and the jurisdiction of the New England Fish Management Council, combine to justify using New England as the outer geographic boundary for the groundfish processing sector.

Smaller or more extended geographic areas fail to satisfy minimum relevant market criteria. The area where a processor sells most of its product (usually not far from the port where the whole fish is landed) would not qualify as a market because the costs of bringing in fresh product from other New England processors are minimal. On the other hand, though many if not most New England groundfish processors ship to customers outside New England some as far away as Florida and California--the largest share of the output of New England processors is sold within New England. Unless and until processors

outside the region account for more than half of the groundfish consumed there, New England appears to be the relevant market for estimating market power in the sale of groundfish.

From the input side of both fresh and frozen processing markets, New England can be regarded as a distinct geographic market. Some New England processors have strong connections with particular Canadian brokers, but as with the sale of fillets, the New England processor cannot exclude its competitors from buying whole fish or fillets through the same broker. Even if the processor had established a kind of lock or preferred position, shortage of Canadian groundfish has weakened or destroyed the connection.

Fresh and frozen groundfish as distinct products

In considering the output of fresh fillets of major groundfish species: cod, haddock, flounder and pollock, as a single relevant product, we are following industry usage. The products are not perfect substitutes, but they are extremely close, and most processors cut at least two of the species. Consumers do not consider frozen fillets to be the equivalent of fresh, as witnessed by the prevailing practice of retailers selling refreshed (frozen converted to fresh) fillets when the fresh product is in short supply. Other frozen fish products--breaded and cooked sticks, portions, nuggets etc. are clearly only imperfect substitutes for fresh fillets, and the structure of the frozen fish product market in New England will therefore be examined separately.

FRESH PRODUCT MARKET STRUCTURE

Survival strategies substantially altered the structure of the fresh processing sector. Since changes in structure can increase or create centers of market power, and, in any event, are sometimes associated with changes in competitive behavior, it is useful to examine this by-product of the supply crisis. Did an unintended consequence of the reduction in the number of sellers (and buyers) in the New England groundfish industry enable them to offset the supply shortage by selling at more favorable prices, and paying less for their whole fish?

The number of fresh groundfish processors fell by 40% from 100 in 1990, to 60 in 1997, the last year for which information by product type by plant is available (Figure 4). Average fillet production per plant fell from 680,000 lb. in 1990 to 300,000 lb or 63%, in 1997 (Georgianna and Dirlam, 1999). The average dollar value of sales however, rose 15% from \$2.77 million in 1990 to \$3.1 million in 1997 in constant dollars. As noted earlier, the decline in the number of processing firms was accounted for not only by liquidation but also by their transformation into wholesaling. An arithmetic average of dollar sales suffers from certain deficiencies, but it does indicate that those firms that did not exit fresh fish processing enjoyed a final price roughly offsetting the fall in output. Average employment per plant also remained constant, at about 16-17 per firm. Employment figures are not wholly reliable, however, because fresh fish processors have tended to contract out for services of cutters and other employees. The implications for estimating the minimum efficient firm are that

that its dollar volume of sales should be around \$3 million per year.

Changes in concentration

Concentration of output can be measured by estimating the share of the largest 4 (CR 4) and the largest 8 (CR 8) firms. Applying this test it appears that the New England fresh fillet industry was significantly concentrated in 1990 and has increased subsequently. Between 1990 and 1997, the CR 4 ratio rose from 43% to 58%, and the CR8 ratio from 57% to 70% (Georgianna and Dirlam, 1999). This left only 30% of the market to be shared in 1997 by the remaining 52 firms. Where CR4 is above 50% the market is usually classified as an oligopoly, where the largest firms are capable of exercising a moderate degree of market power.

The Hirschman-Herfindahl Index (HHI) provides a measure of inequality of market shares. The index is derived by squaring and summing up the market share of each firm in the market. A one-firm industry would have an index of 10,000; if 100 equally sized firm share the market the index will be 100. The Antitrust Guidelines classify a market with an HHI of 1,800 as highly concentrated, and with less than 1,000 as effectively competitive. Unlike the CR 4 or the CR8, the HHI takes into account the market share of every firm, and by squaring the share percentages, it emphasizes the role of large firms. A CR 4 of 100% would have an HHI of 2,500 if each firm had 25% of the market, but if one firm had 97%, the HHI would be 9,412.

The New England fresh fish processing market HHI was low during the years 1990--1994, with a minimum of 600 in 1993, but by 1997, it had risen to 1200, bringing it beyond the threshold of Guidelines' concerns.

Competition and Structure in Leading Ports

Concentration ratios by port are, to be sure, in quite high ranges: CR4 for Portland is close to 100%, New Bedford 82%, Gloucester 90% and Boston, 75% (Georgianna and Dirlam, 1999). HHIs are in each case extremely high. And in New Bedford and Boston, sharp increases reflect the fact that one or two large processors now account for an even larger share of output. Our examination of competition in the ports indicates that, in effect, they do not constitute distinct geographic markets. Processors in each port compete for orders by the same regional fillet customers. And while Boston now plays an even more important role as a destination for fish landed or auctioned off in Gloucester and Portland, the net return to the sellers of whole fish has if anything improved.

Market Structure and Competition

Despite the relatively high indices of concentration, and especially inequality of market shares, there is little evidence that the larger firms have been better able to exercise market power to the detriment of either their

customers or their suppliers. Small scale customers, such as fish markets have been replaced by larger and ever more powerful regional and national supermarkets and food service companies. Even the largest of the processors must cut costs to the bone to win or keep contracts with these big buyers. And while some smaller competitors complain that the larger firms have been able to maintain exclusive rights to landings by some of the trawlers, there is, as far as we can tell, little indication that collusion or dominant firm behavior has distorted auction prices by artificially depressing ex-vessel prices.

Conventionally, highly concentrated market structure and behavior are linked, above all and first and foremost, by generating prices above those that would prevail were there effective competition among a large number of firms. Wholesale prices of processed groundfish in the geographic New England market could very well, given the prevailing concentration levels, be determined by collusion, tacit agreement, or price leadership by one or two dominant firms. Margins and profits would tend to be higher than in effectively competitive markets. Our analysis shows just the opposite. Although wholesale transaction prices and quantities are no longer available, we were able to calculate processors' operating margin for a typical important species, yellowtail flounder, from 1987 to 1997, which rose to a peak of 40% in 1990, and fell to 15% in 1997 (Georgianna and Dirlam, 1999).

The larger processors have been able to maintain profit margins of 1 to 2%, leaving them an adequate return on investment, by practices noted earlier: substituting new products, rigorously controlling operating costs, and, by providing reliability and uniform quality, selling to a few, much larger customers, thus cutting shipping and marketing costs.

FROZEN PRODUCT MARKET STRUCTURE

Products of New England frozen groundfish plants consist of sticks and portions, fillets and, to compete with specialized plants elsewhere, a widening variety of cooked and breaded products. Total value of product fell 33 1/3% from \$600 million in 1990 to \$400 million in 1997; physical volume by a somewhat similar percentage--prices of frozen products have not appreciated substantially. Prior to the drastic decline in cod stocks, raw material consisted of blocks imported almost exclusively from Canada, Iceland and Norway. Currently, pollock blocks mostly from Russia have largely replaced these earlier sources. Only rarely if ever were New England groundfish landings processed into frozen blocks.

Number of Plants and Market Share

Although the number of frozen fish product plants in New England has not been officially reported, it is common knowledge that there are only four of importance: Frionor, Fishery Products, Gortons, and National Sea Products. We have no reason to believe that the share of the big 4, which we estimate at 70%, has altered appreciably. A CR 4 ratio summarizes the New England frozen products industry in both

1990 and 1997. It is possible that the HHI has shifted, but we don't know in which direction. See Figure 3.

It may be that the processing plant totals appearing in Figure 5 include shellfish, squid, monkfish, skate, and lobster marketers as well as plants producing fresh and frozen products. In any event it was impossible for us to allocate the residual 225 plants in 1990, and 80 plants in 1997 not producing fillets between frozen and fresh products other than fillets.

CONCLUSIONS

In an earlier publication, we summarized New England groundfish processors' reactions to the decline in supply of whole fish, the resultant changes in industry structure, and our predictions as to future developments (Georgianna and Dirlam, 1994). From our current interviews and data analysis, we conclude that almost all trends in structure and in management policies we found in 1994 have continued and intensified.

1. Despite the continuing decline of groundfish landings at the port, Boston continues to lead fresh groundfish processing in New England. In 1997, Boston landed only about 10% of the area's total groundfish landings, but it produced about 50% of the New England's fresh fillets. Boston's share of New England's fillet production has remained close to 50% since 1992, but Boston firms have increased their share of the fresh fish market in other ways. Air-freighted whole Pacific cod, and most substitutes for or supplements to local fresh fillets, such as imported fresh fillets, are flown into Logan Airport, which is easily accessible to Boston processors. Boston processing firms have reinforced their port's position as the leading processing center in New England, with all the associated brokerage, packing, transport, and wholesaling activities that support processing. In other words, Boston processing firms have kept and probably expanded their customer base.
2. With the possible exception of Gloucester, processors in other ports have not fared as well as those in Boston. Processors in smaller ports have either disappeared or now supply only small amounts to local customers. The same is true for Portland processors, who have not gained much from the success of the Portland display auction. Some New Bedford processors switched to monkfish, dogfish, and skate when landings of these species increased, selling them to a different set of customers from those that bought groundfish fillets. New Bedford has lost its dominance in flounder production, and Boston firms produce much of the port's fresh groundfish fillets with plants in New Bedford. Gloucester has maintained its small niche in fresh fillet production.

3. Long-term relationships or loyalties between processors, their suppliers, and their customers have continued to erode, contributing to the day to day variability of exvessel input prices on the one hand, and wholesale prices on the other. As we noted in 1993, when loyalties vanish, hard bargaining takes their place. Although operating and profit margins may not have changed radically on an annualized basis for the firms that still process groundfish, profit margins have become increasingly difficult to maintained in each transaction and over time.
4. The survival techniques we noted in 1993, including importing fresh fillets, exploiting niches, substituting for groundfish, focusing more on wholesaling, and closely watching the bottom line, have been extended, and became essential features of successful processors' purchasing and marketing strategies. Whereas in 1993, West Coast whole cod was something of a novelty, many processors today buy frozen whole fish from the West Coast and Alaska as a matter of course. And other new sources have been tapped to replace the shrinking supply of Canadian whole groundfish. As the shortage of the major groundfish species persisted and became accentuated, consumers have become willing to accept domestic and imported substitutes. Those firms that adapted to or promoted the change have been able to diversify their output and maintain volume. Many small processors, however, which were the most dependent on a relatively stable price structure and easy availability of whole groundfish, have not been able to finance the initiation and successful maintenance of these innovative strategies and have quit the industry. The number of processors has, accordingly, continued to decline.
5. Boston's advantages in transport costs and clustering far outweigh access to local landings of processors in other ports. Processors at other ports, dependent on local landings, have not found it easy to implement any of these survival strategies.
6. As the smaller firms have turned to wholesaling or simply vanished, not only are there fewer, and typically larger firms, but the processors' markets have become even more concentrated than in 1992. Market buying power has not, however, increased to the same extent as the higher concentration ratios. As far as we can tell, collusion among a few buyers, if it exists, has not been able to distort the auction process by depressing prices. In the wholesale and retail markets, small-scale customers, such as fish markets, have disappeared due to customer preference for convenience. The larger processing firms now compete among themselves for orders from even larger and more powerful super markets and food service companies. Increasing concentration in this declining market has not given large processing firms market power as sellers in wholesale markets.
7. Though no processor can be said to enjoy an assured supply of whole fish, large firms are better able to draw on widely scattered geographic sources, and adapt to display auctions, now an indispensable source of domestic whole fish. The forces that are reshaping the structure of the processing industry are, therefore, real economies of scale. While the high levels of the concentration ratios and the HHI considered in the abstract might seem to convey substantial market power to large processors, the pressure on margins that has accompanied the falling supply has effectively prevented concentration from leading to non-competitive prices and profits.
8. In our previous report (Georgianna and Dirlam, 1993), we assumed that increased supplies of underutilized species such as monkfish, skate, and dogfish would very likely lead to intense price competition for a small share of established markets. This did not occur. Demand expanded for these and other species, followed by intensive fishing and then stock declines. These formerly underutilized stocks are now severely depleted, and U.S. Department of Commerce is preparing restrictive management plans for these species.
9. In our previous report, we observed an increase in the number of wholesaling firms and wholesaling employment, which we attributed to some firms switching from cutting fillets to simply buying and selling whole fish or previously processed fillets. We predicted that many of these entries into wholesaling were temporary, because some of the firms that switched from processing to wholesaling could not survive competitive pressure in the wholesaling sector. There is some but not conclusive evidence for this. Massachusetts Division of Employment and Training data show a decline in the rate of increase in the number of firms and an absolute decline in wholesaling employment.
10. Although stock recovery does not look promising for any Atlantic groundfish species, an increase in groundfish stocks and landings could stabilize or may even reverse declines in employment and in the number of processing firms. Many of the changes in structure of groundfish processing due to supply shortages, for example, the dominance of Boston firms, the growing importance of display auctions, and weakened customer loyalty, will probably not be affected by increases in landings, when and if stocks recover.

ACKNOWLEDGMENTS

Partial funding for this study was supplied by the Saltonstall-Kennedy Program, contract 96-NER-095, NMFS. The authors wish to thank research assistants Peter Amaral and Jared Schmidek for preparing figures and data analysis. The authors also wish to thank Steve Koplín from the Fishery Statistics and Economics Division, NMFS for supply data and descriptions of processed products and imports, John Walden from the Northeast Fisheries Science Center, NMFS for supplying landings data and Leo Gaudin from New York Market News, NMFS for supplying wholesale prices. NMFS port agents Dennis Main in New Bedford, Don Mason in Gloucester, Bob Merrill in Portland, and Paul Sheahan and Jack French in Boston gave information and explanations of the processing sector in their ports. More than 20 fresh fish processing plant owners and managers and industry representatives gave us interviews explaining their business. We also wish to thank Priscilla Brooks from the Conservation Law Foundation and other reviewers for their comments. While these people were very helpful, the authors take full responsibility for the contents of this report

SOURCES.

- Georgianna, D. 1999. The Massachusetts fishing industry. *Massachusetts Benchmarks. The Quarterly Review of Economic News & Insight*. Vol 2:3.
- Georgianna, D. and J. Dirlam. 1999. The Effects of reduced groundfish landings on New England Fresh Fish Processors. Final Report for Saltonstall-Kennedy 96-NER-095, NMFS, U. S. Department of Commerce.
- Georgianna, D. and J. Dirlam. 1994. Recent adjustments in New England groundfish processing. *Marine Resource Economics*, Vol 9:375-384.
- Georgianna, D., J. Dirlam, and R. Townsend. 1993. The Groundfish and Scallop Processing Sectors in New England. Prepared for NMFS, U. S. Department of Commerce.
- Leung, Shirley. 1998. Fish from Iceland makes a splash in New England. *Wall Street Journal*, 3/11/98, p. NE1.
- Massachusetts Department of Employment and Training. 1999. ES202 File. Boston
- Metropolitan Area Planning Council. 1998. Strengthening the Seafood Industry in Massachusetts: Shoreline Processing and Distribution Sectors.
- Northeast Fisheries Science Center. 1998. Status of the Fishery Resources off the Northeastern United States, Stephen H. Clark, Editor. *NOAA Technical Memorandum NMFS-NE*.

National Marine Fisheries Service. Various years. *Fisheries of the United States*. U.S. Department of Commerce.

National Marine Fisheries Service. 1999. *Fishery Statistics* <http://www.st.nmfs.gov/st1/index.html> U.S. Department of Commerce.

Wang, Stanley D.H. and Rosenberg, Andrew A. 1997. U.S. New England groundfish management under the Magnuson-Stevens Fishery Conservation and Management Act. *Marine Resource Economics*. 12:361-366.