Frozen Seafoods: The Economic Feasibility of Quality Assurance to the Consumer

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Background

The most persistent and most unassailable critic of the quality of seafoods available to the U.S. public has been the Consumers Union, which publishes a widely read and respected magazine, *Consumer Reports.* In the 1960's and 1970's this magazine provided data from the publisher's objective surveys condemning the quality of seafoods nationwide (Anonymous, 1961). These surveys were corroborated by others, notably the surveys carried out by the Northeast Fisheries Center (NEFC) Gloucester Laboratory of the National Marine Fisheries Service[1] (NMFS) during 1963 and 1964.

It is important to note that none of these surveys placed any blame on specific segments of the U.S. seafood industry, not only because many of the products sampled were produced from imported fish, but especially because the domestic industry offered a most varied and complex picture.

Yet, even though the U.S. seafood industry had to be considered largely blameless, the problems associated with the industry were seemingly insoluble and they clearly had adverse economic and social implications for the country. Outstanding among these problems were: 1) The unfavorable image of fish as food; 2) the relatively stagnant per capita consumption of seafoods; and, 3) the inability of the industry to supply the domestic market, much less to compete with foreign seafood industries in international markets, resulting in an increasing seafood trade deficit that is currently overshadowed only by those of oil and automobiles (Gorga and Ronsivalli, 1981).

In the early 1970's, an integration of relevant economic and technological data led the Gloucester Laboratory to the conclusion that these problems stemmed from a lack of consistently high quality. Therefore, the following simplifying hypothesis was formulated: "If consistently high quality could be assured to the consumer, the consumption of seafoods would increase and many problems of the industry would be abated."

To test the validity of this hypothesis, multifaceted efforts were undertaken to apply much of the known technology and thus improve the ability of the industry to assure quality. These efforts encountered a resistance rooted in such understandable preoccupations as: 1) "It would cost too much to assure quality"; 2) "a program of quality assurance has been tried many times but always failed"; 3) fish prices are too high already"; 4) "people do not know how to prepare fish"; 5) fish smell up the house and utensils"; 6) "only a small number of people eat fish anyway"; etc.

The Gloucester Laboratory therefore found it necessary to design and to implement a strategy to convince the U.S. seafood industry that it pays to assure the quality of its products to the consumer, and to convince the nation that it pays to have a competitive U.S. seafood industry. The keystone of this strategy was the realization that to assure quality would take an integrated effort, combining the technical and leadership skills of the Gloucester Laboratory with the practical knowledge and facilities of cooperative seafood processors and seafood retailers. Thus, the first experiment concerning the assurance of the quality of fresh fillets to the consumer was organized and carried out. A brief review of this experiment helps to explain the current experiment concerning frozen fillets.

Quality Assurance of Fresh Fish Fillets

An internal proposal[2] by the Gloucester Laboratory described a

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[1]Tenney, R. D., J. P. Lane, J. Carver, and M. Steinberg. 1965. Internal report — survey on quality of retail frozen fillets. Bur. Commer. Fish., Technol. Lab., Gloucester, Mass.

[2]Ronsivalli, L. J. 1974. A study to determine the effect of assured quality of fish on its sales volume. An internal proposal. Natl. Mar. Fish. Serv., Gloucester Lab., Gloucester, MA 01930-2599.

comprehensive scheme, from point of catch to point of sale, that would deliver to the consumer seafoods of no less than U.S. Grade A quality. The highest quality was targeted because of the established image of poor seafood quality; and, obviously, because it would take the delivery of consistently high-quality seafoods if the consumer were to begin to view fish as other than "fishy."

The project got underway in 1974. Without the inclusion of fishermen, whose involvement—although not essential—was vigorously attempted without success, the quality control and inspection activities that are required to assure quality started at the point of landing rather than at sea. From that point on, the experiment was able to control quality up to the point of sale. This strict quality control regimen, also described in Ronsivalli et al. (1978) and Ronsivalli (1981), involved only two supermarkets at a time, but a total of six supermarkets participated during the 2 years of the project's operation. At the end of the project, an economic analysis was made, and when the findings were extrapolated to an activity involving a production rate of 10,000 pounds of fish fillets/day, an efficient production rate, the analysis showed that the unit cost to assure quality was $0.10 per pound (Gorga et al., 1979). The analysis also showed that even this added cost was nullified because quality assurance helped eliminate losses due to spoilage and to markdowns. Thus, the analysis showed that it required no added cost to assure quality.

Ultimately, in that experiment, it was proved that it was economically feasible to produce and distribute products of consistently high quality, because customers were willing to pay up to $0.50 per pound more for guaranteed quality fillets than for fillets whose quality was not guaranteed by the U.S. Grade A shield and by the implicit pledge of the retailer to withdraw from sale those products which were about to fall below the U.S. Grade A standard of quality.

Thus, the fears that it would cost too much to assure the quality of seafoods, that customers would not pay a higher price for quality assurance, and that quality assurance could not be attained were all found to be without basis. Supermarket operators were impressed not only with the suggested practice of prepackaging the fillets at the processor level, but especially with the elimination of consumer complaints. As expected, consumer satisfaction was reflected in significant increases in seafood sales during and especially after the experiment—when the duplication of the experimental design began to spread due to the obvious economic advantages of quality assurance for processors, retailers, and consumers.

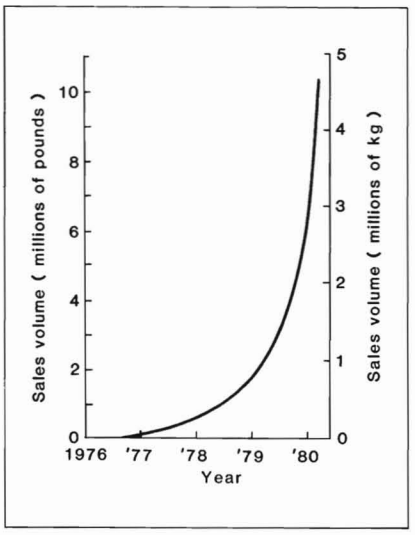

Figure 1.—Growth rates of sales of fresh fish fillets carrying the U.S. Grade A shield.

The sum total of these projects exposed the existence of a burgeoning demand for high quality seafoods that has created a full-scale revolution in seafood marketing (Anonymous, 1981).

Verification of the Hypothesis and Basis for Further Experiments

After nearly a decade of efforts in quality assurance, the Gloucester Laboratory analyzed the industry's progress to arrive at some measure of the validity of the original hypothesis that lack of quality in seafoods is the principal deterrent to consumption. Findings (Ronsivalli et al., 1981) exceeded expectations.

Figure 1 shows the growth of (presumably additional) sales due to the program of quality assurance. Even though the program was running with little or no assistance from the Gloucester Laboratory by this time, its growth maintained an exponential trend. Within 4 years, the sales volume had reached 11,000,000 pounds per year with a value of about $30,000,000 per year. The number of stores had increased to more than 1,100, the number of processors had increased to more than 10, and the market area had expanded to include the 15 northeastern states.

One does not yet see these figures reflected in an increase in per capita consumption of seafoods in the United States, not only because the quantity of high quality or U.S. Grade A fresh fish measured against the entire seafood market is still comparatively small, but especially because in recent years there has been a decrease in the sale of frozen fishery products (Anonymous, 1981) and even a decline in the number of pounds of edible, mostly frozen, fishery products imported from abroad (USDOC, 1981).

Beyond these quantitative measurements, perhaps the best evidence of the significance of quality assurance of seafoods, whether in terms of its effect on the seafood industry or in terms of its benefits to the consumer and to the nation, is the existence of a large number of proposals and commitments to improve the quality of seafoods both in the United States and abroad (Gorga and Ronsivalli, 1981).

The ultimate reason for these efforts can be found in the existence of a difficult to measure, but evidently high latent demand for quality seafoods. As can be seen from the slope of the curve in Figure 1, which in 1980 was at its highest value, consumer demand for U.S. Grade A fresh fish fillets had not even begun to be satisfied—otherwise the curve would have started to "flat-

ten out." On the other hand, there were indications that the supply of U.S. Grade A quality fish fillets might not be able to satisfy a much higher demand (Ronsivalli et al., 1978).

It was this interplay between demand and supply that led the Gloucester Laboratory to consider whether the assurance of quality could not be extended to cover the production and distribution of frozen fish. The aim was to lay the groundwork for an eventual integration of the two programs: All fish that can be sold as U.S. Grade A fresh fish should be so sold; the rest should be sold as U.S. Grade A frozen fish. Thus we reach the core of the rationale for the study under consideration in this report.

The Rationale for Quality Assurance of Frozen Fish Fillets

Although mainly imported, frozen fish fillets compose the bulk of the fillet supply in the United States. It has therefore been hypothesized that a successful effort to assure the quality of domestic frozen fillets should result in even higher benefits to the industry and the consumer than those experienced in the program of quality assurance of fresh fish fillets (Nickerson and Ronsivalli, 1979).

Specifically, the hypothesis is that quality assurance is the key factor in conquering the core of the problem associated with the production of frozen fish fillets in the United States. This is a three-part socioeconomic problem that can be described as follows: 1) U.S. consumers are generally of the opinion that frozen fish fillets can never be of as high a quality as fresh fish fillets. This widespread opinion is reflected in, and supported by, the fact that the prices for fresh fillets are generally higher than those for their frozen counterparts; 2) it costs more to produce frozen fish fillets than to produce fresh fish fillets; and finally, 3) because of this economic discrepancy, a producer or handler of fillets might be motivated to freeze the product only when it appears that the probability of selling it as fresh is dangerously low or at a time when the fillets are at or near incipient spoilage—a practice which normally does not result in acceptable frozen products, and which propagates the first part of the problem.

A study was conducted in 1981 to test the validity of the hypothesis that quality assurance is capable of resolving this complex problem. The following sections report on the economic aspects of this experiment and attempt to determine whether it is indeed economically feasible to assure the quality of frozen fish fillets to the consumer.

Experimental Design and Procedures

Sample Design

An informal search among seafood processors led to the selection of Aslanis Fisheries of Boston, Mass., as the producer participating in the study. Even though this enterprise did not directly fillet most of the fish, it met all other basic criteria operating in the search: 1) Financial, technical, and organizational capability for producing U.S. Grade A frozen seafoods; 2) willingness to have its plant under continuous USDOC inspection; and 3) willingness to participate in the study.

At the same time that arrangements were made with the processor, it was also decided to select nine retail stores to follow the product all the way to the point of sale. Three stores were to serve as test stores; three as control stores; and three stores were to be used for special studies (e.g., the effect of price variations upon sales or the impact of an experimental display case upon cost savings and sales).

The retail chain, which was selected with full cooperation and assistance by the processor, did in fact provide nine stores, here identified as Store No. 1-9, and data were collected from these stores during the first 3 weeks of the experiment. However, since the chain became enthusiastic about the product and introduced it in all of its stores from the outset, a change in the experimental design became unavoidable. The intent to keep three stores as control stores and three stores for special studies was rendered nonoperational. Then, not only was the number of test stores enlarged to five, but there was also a shift in the composition of the stores: Four stores, No. 2, 4, 5, and 6, remained in the sample and a new one was added to it, Store No. 10. The other stores were withdrawn from the study.

Store Location

As pointed out earlier, the cost of producing frozen fish is higher than that of fresh fish, while retail prices tend to be lower for frozen fish. Therefore, an attempt was made to select stores away from the coast because, on the coast, such an economic dysfunction is more likely to be felt. This selection was also dictated by the presumption that sales of frozen fish are higher inland than along the coast.

After trying to select a supermarket chain in the Detroit, Mich., area, final selection of sample stores settled upon the next best alternative: A chain (Price Chopper) in the Albany/Schenectady area of New York.

Of especial socioeconomic interest is the fact that the five stores that participated in the test for the longest period of time are located along an axis that starts at the center of Albany and ends at the periphery of Schenectedy. Figure 2 presents a schematic representation of this geographic arrangement. This disposition is interesting because it is an approximate representation of various socioeconomic strata of store customers, from low, to middle, and to upper income.

Data Collection

In this study, unlike the previous one on fresh fish, control over all phases of the operation was retained by private industry. Consequently, responsibility for the collection of relevant data—with the exception of spot checks for temperature—was also assumed by private industry.

Thus, data on production volumes and costs for cod, haddock, pollock, and ocean perch were collected by the processor for January to June 1981. Data for retail sales and consumer prices were collected by the supermarket chain for frozen Grade A,

Table 1.—Production volume, by month, in pounds.

Species	January	February	March	April	May	June	Total
Cod	6,780	11,073	0	2,960	3,890	1,492	26,195
Haddock	8,570	14,681	0	0	5,945	0	29,196
Pollock	2,000	1,852	2,000	4,100	3,500	0	13,452
Ocean perch	3,200	2,680	1,840	2,060	0	4,829	14,789
Total	20,550	30,466	3,840	9,120	13,335	6,321	83,632

Table 2.—Processor sales, by month, in pounds.

Species	January	February	March	April	May	June	Total
Cod	5,200	3,000	2,900	320	1,000	300	12,720
Haddock	7,600	1,510	2,780	280	2,020	380	14,570
Pollock	1,800	2,020	1,560	40	1,000	0	6,420
Ocean perch	3,000	2,120	2,560	100	1,000	0	8,780
Total	17,600	8,650	9,800	740	5,020	680	42,490

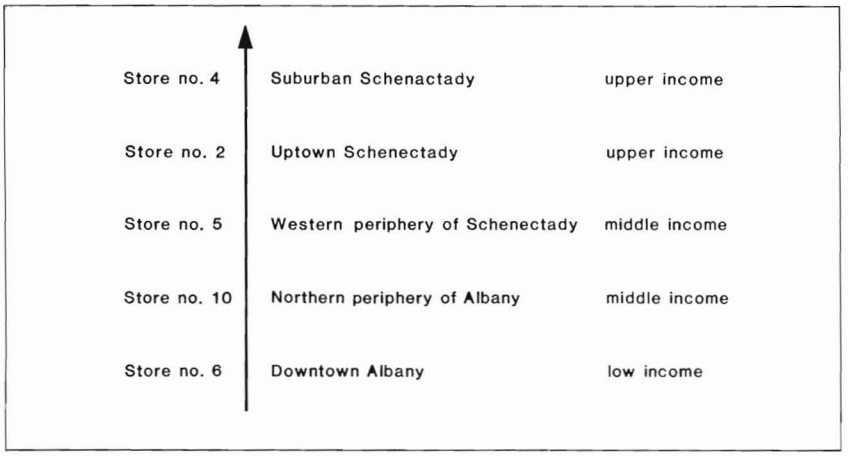

Figure 2.—Schematic representation of geographic location of test stores and income status of customers. The geographical axis runs from southeast to northwest.

Table 3.—Unit production costs per pound.

Item	Cost	Item	Cost
Raw material	$1.460[1]	Direct labor	$0.023[2]
Film—top	0.039	3 Vac. pac machines	0.013[3]
Film—bottom	0.052	Inspection	0.013[4]
Carton	0.018	Miscellaneous	0.100[5]
Label	0.011	Overhead	
Recipe label	0.006		
Tape	0.001	Total	$1.74

[1]Weighted average price per pound for the four species mentioned in the text. (Price per pound × pounds per species ÷ total pounds.)

[2]23 workers at $4.32/hour, producing 4,305 pounds/hour, or 4,920 packs at 14 ounces average per pack.

[3]Value of machines: $161,465 amortized over 5 years, interest not included, and producing an average of 10,000 pounds for 250 days per year, an efficient production rate.

[4]$32.60 hours × 4 hours ÷ 10,000 pounds. Actual inspection cost as an average of 6 months activity was $0.045.

[5]Includes freezing costs and especially the high cost of keeping working rooms temperature at 40°F as well as the related cost of high labor turnover due to uncomfortable working conditions. No better estimate of these costs can be reached because it is difficult to separate the production volume covered by this study from the total production volume of the firm.

frozen ungraded, and fresh fish fillets from February to May 1981.

In addition to the four species for which data were collected at the processor level, at the retail level data concerning sales and prices were collected for flounder as well. These data were collected in test stores for 1-14 nonconsecutive weeks, for a total of 16 weeks. Data for total meat department sales including meat and fish, and percentages for various items of this total were also collected for about 2 years starting with the week of 21 October 1979, more than 1 year before the beginning of this study. At the processor level data were collected monthly, while retail data were collected weekly.

Results and Discussion

We will first analyze the findings concerning the operation of the processor, and then that of the retailer. We will join the two sets of issues in the last two sections, Conclusions and Recommendations.

Production Volume

During 6 months of the study, the processor purchased and processed 83,632 pounds of cod, haddock, pollock, and ocean perch in the U.S. Grade A frozen fillet form. During the same period, processor sales of the same species to retail stores throughout the United States were 42,490 pounds. (The processor was also involved in the production of other species and other market forms at the same time.) A sizeable inventory of 41,142 pounds (83,632 pounds produced minus 42,490 pounds sold) was built up at the end of this period.

Production volumes were much higher in January and February than in other months (Table 1), and peak production occurred in February. Sales volumes were highest in January (Table 2). Peak production and sales volumes were seen for haddock frozen fillets.

Production Costs

Unit cost for the production of frozen U.S. Grade A fillets (Table 3) was $1.74 per pound. No overhead costs are included in this estimate. In particular, the high cost of raw material must be noted. This cost must be ascribed not only to the organizational structure of the business itself: The processor participating in the study was buying already filleted (rather

than whole) fish. This cost must also be ascribed to the exceptional weather conditions prevailing when the production of U.S. Grade A frozen fillets was initiated: In December and January, New England harbors were frozen, and in March and April exceptionally high winds prevailed. Fish landed were sold at premium prices.

The cost differential to produce U.S. Grade A or ungraded frozen fillets was estimated by the processor to be approximately $0.10 per pound. This result agrees with the cost differential to produce U.S. Grade A fresh fish fillets as described earlier.

One of the major items for this cost differential is the inspection cost, estimated to be $0.045 per pound on an actual basis and $0.013 per pound at full and exclusive production of graded fish. To either one of these figures, one must add a few more cents for additional trimming to improve the aesthetic appearance of the product and/or eliminate the presence of bones and other defects as required by the U.S. Grade A standard. The majority of other costs can be assumed to be identical for graded and ungraded products.

Processor Markups

As can be seen in detail from Table 4, processor markups varied from a low of $0.42 per pound to a high of $0.96 per pound. Taking into account quantities sold for each species, the overall weighted average markup was $0.78 per pound.

Markups are equal to sales prices minus costs of raw material. Both prices are given here as weighted averages: $2.24 per pound for sales prices and $1.46 per pound for costs of raw material. Processor costs of raw material and sales prices are not given in detail to avoid disclosure of proprietary information.

Processor Profit Margin

Subtracting raw material costs (Table 3) from overall production costs, one obtains a "gross" production cost of $0.28 per pound: This figure does not include overhead costs.

Subtracting from the overall weighted average markup ($0.78) the figure for gross production cost ($0.28) one obtains a "gross" profit margin for the processor of approximately $0.50 per pound. Profit margins are equal to markups minus costs of production.

Retail Sales

During the study, total retail sales in the test stores were 20,384 pounds of fresh and frozen fish fillets (Table 5). Of these, 12,997 pounds (64 percent of the total) were fresh fish fillets; 3,879 pounds (19 percent of the total) were ungraded frozen fillets. U.S. Grade A frozen fillets were 3,508 pounds, representing 17 percent of total fish sales.

The pounds of U.S. Grade A frozen fillets purchased for various technological tests by the Gloucester Laboratory should have been subtracted from these totals. However, they were not because the amount (about 200 pounds) was small, and they were observed as actual sales by the retailer.

More meaningful breakdowns are presented in Tables 6, 7, and 8. Table 6 includes the breakdown of retail sales

Table 4.—Processor markups in dollars per pounds, by month.

Species	Jan.	Feb.	Mar.	Apr.	May	June
Cod	$0.732	$0.88	NA[1]	$0.762	$0.60	$0.70
Haddock	0.596	0.957	NA	NA	0.54	NA
Pollock	0.55	0.419	$0.459	0.551	0.55	NA
Ocean perch	0.87	0.762	0.579	0.943	NA	NA

[1]NA = Not available.

Table 5.—Total retail sales by type, in pounds.

Type of sales	Retail sales (pounds)	Percentage of total sales
Frozen Grade A	3,508	17%
Frozen ungraded	3,879	19%
Fresh	12,997	64%
Total	20,384	

Table 6.—Total retail sales by week (in pounds).

	Retail sales by week													
Item	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Grade A	68	115	313	506	289	314	313	388	425	447	172	24	60	70
Ungraded	437	427	503	354	287	279	260	137	263	368	309	30	140	85
Fresh	808	555	1,125	2,030	1,546	1,236	1,334	1,010	583	1,351	688	216	205	310
Total	1,313	1,097	1,945	2,890	2,122	1,829	1,907	1,535	1,271	2,166	1,169	270	405	465
Percentages														
Grade A	5%	10%	16%	18%	14%	17%	16%	25%	33%	21%	15%	9%	15%	15%
Ungraded	33%	39%	26%	12%	14%	15%	14%	9%	21%	17%	26%	11%	35%	18%
Fresh	62%	51%	58%	70%	72%	67%	70%	66%	46%	62%	49%	80%	50%	67%

Table 7.—Total retail sales by store (3-week period), in pounds.

	Store number				
Item	1	3	7	8	9
Frozen Grade A	10	29	60	—	39
Frozen ungraded	13	301	250	250	95
Fresh	742	271	460	140	100
Total	765	601	770	390	234
Percentages					
Frozen Grade A	1%	5%	8%	—	16%
Frozen ungraded	2%	50%	32%	64%	42%
Fresh	97%	45%	60%	36%	42%

Table 8.—Total retail sales by store (from 11 to 14 week period), in pounds. Store No. 10 remained in the study for 11 weeks; all other stores remained for 14 weeks.

	Store number				
Item	2	4	5	6	10
Frozen Grade A	663	478	1,391	105	733
Frozen ungraded	251	623	710	635	751
Fresh	3,800	1,814	2,515	2,321	834
Total	4,714	2,915	4,616	3,061	2,318
Percentages					
Frozen Grade A	14%	16%	30%	3%	32%
Frozen ungraded	5%	22%	15%	21%	32%
Fresh	81%	62%	55%	76%	36%

by week. The most important figures to notice are those for the first 9 weeks of the study. They show that in this short period retail sales for U.S. Grade A frozen fillets almost consistently grew from 5 to 33 percent of total fish sales. In subsequent weeks there was a decline. We will later present these figures graphically and discuss them more extensively.

Table 7 presents figures for the five stores which participated in the study only for the first 3 weeks. Worthy of note is Store No. 9 in which sales for the U.S. Grade A frozen fillets were 16 percent of total fish sales. This is an indication that sales of this product can quickly become rather substantial.

Table 8 presents figures for the five stores in which records were collected for the longest period of time. These are the stores which are presented in relation to their geographic location in Figure 2. Correlating Table 8 with Figure 2, it appears that sales of U.S. Grade A frozen fillets were the lowest (3 percent of total fish sales for the store) in the poorest area of downtown Albany (Store No. 6); sales were average (14 and 16 percent of total fish sales for the stores) in the high income areas of uptown and suburban Schenectady (Stores No. 2 and 4); and they were the highest (30 and 32 percent of total fish sales for the stores) in the middle income areas of the western periphery of Schenectady and the northern periphery of Albany (Stores No. 5 and 10).

Retail Sales Trends

As we have seen, retail sales trends varied considerably from week to week. However, smoothing out minor variations, one can detect an increasing trend up to the ninth week of the study and a declining trend in subsequent weeks. Why the decline?

A first hypothesis was that retail prices had a negative influence on sales. Since data for many variables such as customers' income, price and quantity of substitute products, number of repeat orders, advertising expenses, amount of display area, etc., were either not available or not fully correlated, it was not possible to make a regression analysis of the issue. Besides, as can be seen from Table 9, retail prices varied too widely from type to type, species to species, and week to week to have any clear-cut influence on sales. Nor could one attribute the decline in sales from the tenth week to increasing prices. (Indeed, the reverse was the case.)

Upon this realization, a different analysis was performed. It was assumed that "quality" might be the major explanatory variable to determine not only the variations in sales but especially the decrease in the sales trend that, as can be seen from Table 6, started to occur from the tenth week of observation. This trend is more clearly visible when the data is presented graphically (Fig. 3). Percentages of sales rather than absolute values were used not only to eliminate the variations that are inherent in the raw data, but also to have two comparable scales between sales and quality.

The regression line of quality scores superimposed on Figure 3 is derived from a current study[3] which analyzes various aspects of the product under observation. Samples of the product were collected at various stages in their production and distribution and evaluated on a 1 to 9 scale for appearance, odor, flavor, and texture. The results varied from species to species. What is here superimposed on Figure 3 is the regression line that results from aggregating the scores for all quality attributes and all species. The demarcation line between U.S. Grade A and Grade B standard, roughly indicated as an overall score of 5, is also plotted on Figure 3.

[3]"U.S. Grade A Frozen Fish Program — Technological Report" by J. M. Mendelsohn, NMFS Gloucester Laboratory, Gloucester, Mass. In prep.

Table 9.—Retail chain prices (dollars per pound) by week.

Item	Retail price by week													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Frozen Grade A														
Cod	$3.49	$3.49			$2.99	$3.19	$3.19		$3.19	$3.19	$2.69	$2.69		
Haddock	3.49	3.49		$2.99	2.99	3.29	2.98		3.29	3.29	3.29	2.89		
Pollock	2.09	2.09	NA[1]		2.09	1.99	1.99	NA	2.09	2.09	2.09	2.09	NA	$2.09
Flounder	3.89	3.89		2.99	3.89	3.89	3.89		3.89	3.89	3.89	3.89		
Ocean perch	3.69	3.69			3.69	2.98	2.98		3.69	3.69	3.69	3.69		
Frozen Ungraded														
Cod	1.49	1.49			1.49	1.49	1.49		1.49	1.49	1.49	1.49	$1.49	
Haddock	1.98	1.98		1.89	1.98	1.79	1.79	NA	1.98	1.98	1.98	1.98		
Pollock	1.29	1.29	NA		1.29	1.29	1.29		1.29	1.29	1.29	1.29		NA
Flounder	2.29	2.29			2.29	2.29	2.29		2.29	2.29	2.29	1.98		
Ocean perch	1.59	1.59			1.59	1.59	1.59		1.59	1.59	1.59	1.59		
Fresh														
Cod	3.19	3.29		2.29	3.59	3.09	3.09	$2.59	3.29	4.39				
Haddock	2.99	2.89	NA	2.49	3.89	3.19	3.19	$2.89	3.69	4.39				2.29
Pollock		2.09		2.19	1.89	2.09	2.09	1.98	2.65	2.69	NA	NA	NA	
Flounder	4.49			4.19		4.09	4.09	3.19	3.79	4.79				
Ocean perch	3.99	3.79			3.89	3.89	3.19	3.79	3.98					

[1]NA = Not available.

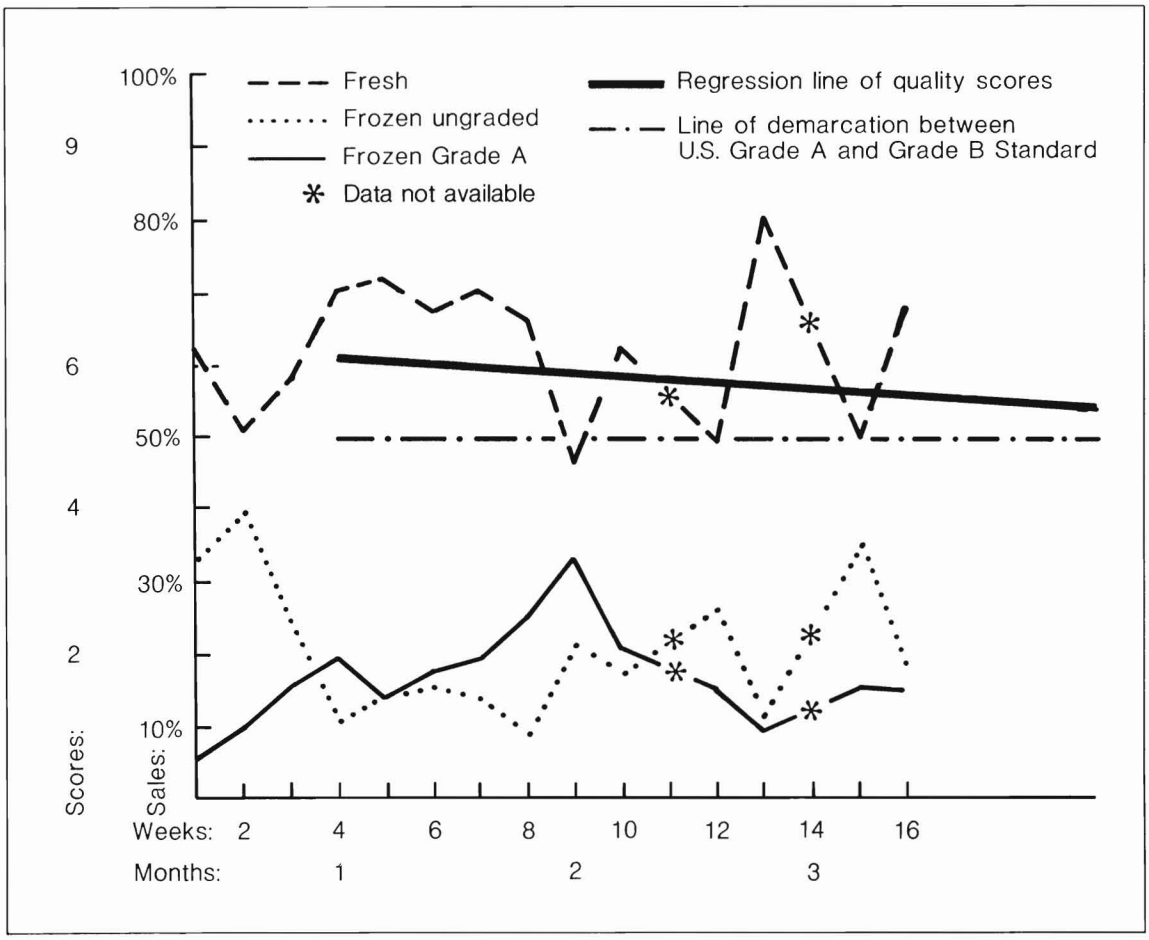

Figure 3.—Quality scores and sales as a percentage of total fish sales.

Observing the relationship between the sales trend for U.S. Grade A frozen fillets and the corresponding regression line of quality scores, one can detect a rather close correlation between the two. Even though the samples never showed very high quality scores, it is still possible to observe that when they were at an overall quality rating of 6 (and presumably higher during the first weeks of observation) the sales trend was moving upward. When the overall quality score approached a value of 5, a borderline value, the sales trend was almost consistently sloping downward.

This correlation, at least on a tentative and partial basis, seems to verify the validity of the hypothesis under which this study was conducted: High quality produces sales, low quality does not. But certainly, as in all scientific investigations, this relationship needs to be confirmed by other and more extended periods of observation.

There are a host of issues involved not only in the declining sales trend starting with the tenth week of the study but also in the explanation for the progressive degradation of the quality of the product during its stay at the retail level. The overriding factors, however, as the Mendelsohn report (footnote 3) will show, were lack of temperature control in the display cases and lack of strict adherence to quality control procedures. In addition, there were some wholly unrelated causes: The tenth week of the study coincided with the week of Good Friday in 1981, an occasion apparently associated with the consumption of fresh rather than frozen fish; and the eleventh week coincided with the coming of spring, a season in which fresh fish starts to become again plentiful and less expensive than in winter.

Yet, even unrelated causes can produce the same effect: Fewer sales. Then there are causes which are more directly related to each other. Besides

those causes that belong especially to the field of temperature control and quality maintenance procedures stressed in the companion report on the technological aspects of this study, at least three related issues that belong to the business/economic field need to be mentioned. From the observation of production codes and discussions with the processor and the retailer participating in the study, it became apparent that quality degradation was also partly due, first, to initial overbuying, and second, to low product turnover.

These two issues are closely intertwined, in the sense that high initial volumes determine low turnover and low turnover breeds poor quality. Fish does not improve with the passage of time. And these two causes are also related to a third one: Pricing policy. Table 9 clearly shows that the supermarket chain participating in the study was in search of the best price level for each species. It left only the price of U.S. Grade A frozen fillets of flounder at the constant price of $3.89 per pound. It changed least the price of pollock, but changed considerably the price of cod, haddock, and ocean perch.

This experimentation with prices, although necessary when introducing a new product, might have had an undeterminable negative effect on the consumer. Was the product ever considered "overpriced" or "underpriced"? Was the linkage between high quality and high price ever broken in the mind of the consumer? As we will see, there is some evidence that sales of U.S. Grade A frozen fillets were higher when their price was set at about the same level as for fresh fish. One can find here other partial explanations for the low turnover, the ultimate quality degradation of the product, and the declining sales in the last weeks of the study.

However, while the pricing change policy might have had a negative short-term impact on sales, in the long run it might also have contributed to the disclosure of three basic characteristics concerning the pricing of U.S. Grade A frozen fish fillets. First, graded frozen fillets can be sold at considerably higher prices than the ungraded ones. With the exception of pollock, for which the difference was still about $0.70-$0.80 per pound, the price for U.S. Grade A frozen fillets was consistently $1.00 to $2.00 higher than the price of ungraded frozen fillets of the same species. (It must be remembered that this large price differential was mostly due to the initial high cost of the raw material.) Second, the price for U.S. Grade A frozen fillets was generally as high as the price for fresh fillets. Thus an assumed major deterrent to the production of high quality frozen seafoods—the higher production cost and lower sales price than fresh fish—appears to be without foundation. Third, high quality frozen fillets seem to sell more briskly at higher than at lower prices. With the exception of the price for flounder and ocean perch, the price for U.S. Grade A frozen fillets was generally higher in the first weeks —when sales were increasing—than in the subsequent weeks of the study. In addition, correlating retail sales by week (Table 6, Fig. 3) with retail prices (Table 9), gives prima facie evidence that when prices were lowered, as in weeks 4 and 5 or 11 and 12, sales declined.

This last relationship is contrary to what generally happens with most products. Higher prices are supposed to dampen sales. However, the above characteristics are all indications that the product is indeed perceived as a "high-quality" product, and, perhaps more important, that the initial high price encourages rather than deters sales.

The full explanation for the willingness of the consumer to pay high prices for a high quality product can be found not only in such sociological factors as "status symbol" or "conspicuous consumption," but also in a combination of formal opportunity cost theory and marginal economic analysis. It is wiser to spend one or two additional dollars per pound than to avoid this extra expense and find the product almost completely worthless.

Normalcy of Trends

From the observation of the above trends, one might be led to the conclusion that retail sales trends were erratic. And indeed they were. However, an analysis of data concerning sales of frozen fish over an almost 2-year period reveals that erratic trends are a normal occurrence for the chain and not an aberration limited to this study. Starting with the week of 21 October 1979, retail sales for frozen fish varied widely from week to week. Rather than reporting the entire series of data, however, only spot checks will be mentioned. Thus, during the week ending 11 November 1979, the percentage of frozen fish sales of total meat department (meat and fish) sales was 0.32 percent, while the following week it was 0.19 percent. The week ending 17 February 1980 it was 0.46 percent, while the following week it was 0.38 percent. The week 16 March 1980 it was 0.39 percent, while the following week it was 0.63 percent. The week ending 29 June 1980 it was 0.24 percent, while the following week it was 0.19 percent. The week ending 10 August 1980 it was 0.30 percent, while the following week it was 0.09 percent.

Available data for some of the same weeks the following year show similar results. The week ending 15 February 1981 the percentage of frozen fish sales over total meat department sales was 0.40 percent, while the following week it was 0.26 percent. The week ending 15 March 1981 it was 0.31 percent, while the following week it was 0.40 percent. The week ending 28 June 1981 it was 0.26 percent, while the following week it was 0.19 percent.

In the end, it might be in the very nature of fish—and especially frozen fish—that sales are erratic for all supermarkets rather than being peculiar to the chain participating in this study. As far as fresh fish is concerned, the season and the weather conspire to create those erratic trends. And as for frozen fish, the consumer might prefer to stock up the freezer rather than to buy a regular supply each week.

Retailer Markup

Averaging all retail prices reported in Table 9 with the exclusion of the prices for flounder to have comparable

figures with processor sale prices and weighting them by the amounts sold, one obtains the weighted average of $3.12 per pound. Averaging all processor sale prices, as we have seen, one obtains the weighted average of $2.24 per pound. Subtracting the latter from the former figure, one obtains a retailer markup of $0.88 per pound.

Retailer Profit Margin

Assuming retail costs (including labor, refrigeration, discards, etc.) to be in the order of $0.20 per pound, it is possible to conclude that the retailer's "gross" profit margin was approximately $0.68 per pound. Not only is this a broad estimate, it must also be considered as a gross profit margin because it does not even attempt to estimate overhead costs.

Conclusions

On the basis of the preceding findings, it is now possible to answer three fundamental questions which have been implicitly addressed in this report: Does the product sell? How much of it can be sold, and at what price? Does it yield a profit?

Does the Product Sell?

Within the confines of this study, the question as to whether it is possible to sell U.S. Grade A frozen fillets can be given a qualified positive answer. The product sells quite well in stores located in middle income neighborhoods. It sells less well in upper income neighborhoods, and it sells poorly in low income neighborhoods. The overall result of 17 percent of all fish sales is an indication that it is possible to sell U.S. Grade A frozen fish fillets. The essential condition is that the product be indeed of high quality.

These conclusions are brought forward by the apparent relationship between quality scores and sales trends. In addition, these conclusions are brought forward not only by the systematic analysis reported above, for, during a relatively short period of time, sales of U.S. Grade A frozen fillets—essentially a new product—surpassed 30 percent of the total fish sales in the two middle income neighborhoods. These conclusions are also brought forward by spot checks. In Store No. 5, during the ninth week of the study, sales of U.S. Grade A frozen fillets had reached 41 percent of total fish sales in that store.

Finally, these conclusions are corroborated by evidence gathered outside the confines of this study. Pier 12, the brand name of the product under study, was reported to be "the fastest moving frozen brand" by Dave Conner, the seafood coordinator of Beyerly's St. Louis Park supermarket in Minnesota. "It outsells any of the frozen fish, I would say, 10 to 1,' Conner says. 'There is no frost buildup, no freezer burn and no shrinkage. It is a high-quality product' " (Cole, 1981).

How Much and At What Price?

The question of how much U.S. Grade A frozen fish can be sold, and at what price, is complex and can be only partially answered through this study. Since this is essentially a new product, it is perhaps too early to say how much of it can be sold. In any case, this part of the question might be better answered through a national marketing study.

The second part of the question, however, can be answered here. U.S. Grade A frozen fillets appear to be selling better at higher than at lower prices. Sales were higher when the price was set at about the same level as fresh fish fillets.

Looking at it from another point of view, it is possible to say that customers were willing to pay up to $2.00 more per pound for graded than for ungraded products.

Does It Yield a Profit?

The question as to whether producing and selling U.S. Grade A frozen fillets yield a profit must also be given a qualified positive answer. As the study shows, there seems to be a high "gross" margin of profit for the retailer—about $0.68 per pound.

The "gross" margin of profit for the processor appears to have been about $0.50 per pound. Indeed, considering the initial inventory accumulation and accompanying interest charges, it is questionable whether the processor earned a net profit on the production of U.S. Grade A frozen fillets while this study was underway. Part of the explanation for the lower profit margin and the initial inventory accumulation must be found not only in the very nature of the business—namely introductory costs for a new product are always high and full profits can be expected only after a substantial period of maturation—but even in the organizational structure of the business itself. The processor was not buying whole fish, but already filleted fish. Thus the operation had to allow for profits for still another enterprise. Finally, the profit margin for the processor was also affected by the high price of raw material due to exceptional weather conditions prevailing when the experiment was conducted.

In summary, the most important conclusions to be drawn from this study are that: 1) It is possible to sell U.S. Grade A frozen fish fillets; 2) consumers are ready to pay from $1.00 to $2.00 more per pound for the graded than the ungraded product, a price differential determined especially by the initial high cost of raw material; and 3) considering retail prices vs. the low cost differential for the production of graded and ungraded fillets (about $0.10 per pound), there is no question as to the profitability of assuring the quality of frozen fillets to the consumer.

In addition, as the study shows, there is a question of distribution of profits. In the short run, the question concerns the profit distribution between retailer and processor(s). In the long run, one must fully expect that the very forces of competition, different initial conditions regarding the raw material, and increased consumer acquaintance with the product will eventually introduce two new actors in the distribution of the profits: The consumer and the fisherman.

As a general result of this study, it can therefore be concluded that a program of Quality Assurance has a high probability of success in solving the very core of the problem associated

with the sale of frozen fish fillets in the United States: High quality frozen fish fillets can be produced at comparatively low cost and can be sold at a price almost as high as the price of fresh fish. If this program is persistently implemented, it seems that it is indeed possible to exploit the vast potential offered by the frozen fish market in the United States (Nickerson and Ronsivalli, 1979).

Recommendations

Rather than listing a whole array of recommendations that transpire through this study, it might be more appropriate to express only three basic recommendations.

First, the processor should try to consolidate fish cutting operations under the umbrella of only one enterprise. Steps toward this end have already been taken by the processor.

Second, the retailer should try to have a better coordination between purchases and sales. With the difficulty of controlling temperatures at the retail level, and with a product ultimately as perishable as even frozen fish is, at least at the beginning of a new sales program it is better to under-buy than to over-buy. Quick turnover is an automatic quality controller. The retailer, too, is already taking steps to implement this recommendation.

A final recommendation is broadly directed to all those who are concerned with the production and sale of fish, rather than specifically to the processor and retailer participating in this study who are already implementing this recommendation. It should be remembered that the original purpose of the endeavor analyzed here is not simply to introduce a new product on the market but to preserve as much fish in the U.S. Grade A standard of quality as possible, thus eliminating damaging peaks and valleys in both prices and supplies. As stressed by various sources (i.e., Gorga et al., 1979), the real need is for an organic program of fish production and distribution, combining both fresh and frozen products: All fish that can be sold fresh should be so sold; the rest should be frozen while it is in a U.S. Grade A quality condition.

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