

## A Concept for Assuring the Quality of Seafoods to Consumers

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**ABSTRACT**—For more than a decade numerous surveys of the quality of seafoods at retail counters have resulted in consistent adverse reports, and it has been concluded that the unreliability of the quality of seafoods is the major reason why their per capita consumption is so much lower than it is for beef, pork, or poultry. A concept for insuring the Grade A quality of seafoods was developed and tested in an attempt to demonstrate that the consumption of fresh fish will increase when their quality and image are improved. This paper describes the concept, its implementation under federal coordination, and its successful implementation by industry which has grown from a pilot operation involving five retail stores and about 200 pounds (91 kg) of fillets per week to over 200 stores and over 15,000 pounds (6,803 kg) of fillets per week — and still growing.

### INTRODUCTION

For more than a decade Consumer's Union has published articles condemning the quality of fishery products available to the American consumer. The following quote (Anonymous, 1965) is a representative sample of that literature.

"One likely reason for this country's low consumption of seafood—which was held at an average of 10 or 11 pounds a year per person for more than a generation—is that most people seldom get to taste the sweet, delicate flavor of fresh-caught fish. It's probable that this plentiful food, rich in protein, vitamins, and minerals and relatively inexpensive, goes a-begging because, by the time it reaches the dinner table, it has usually attained an age and condition warranting its religious connotation as a penance food."

Articles by other consumer groups have been even more damaging to the image of fish as food. Some of them have condemned the processors, because by their brand name they were the only identifiable elements in the distribution chain. The National Marine Fisheries Service (NMFS), previously the Bureau of Commercial Fisheries, was also implicated, because the U.S. inspection sticker was on some of the poor quality samples (Anonymous, 1961). (But in most cases, and certainly

in the cases involving the inspection sticker, the products were of sound quality when they left the plant.)

The per capita (per year) consumption of fish in the United States is about 12 pounds (5.4 kg), while that of beef is about 120 pounds (about 54 kg), that of pork is about 60 pounds (about 27 kg), and that of poultry is about 50 pounds (about 23 kg). It is ironical that the protein source which is considered to be the most desirable from a health point of view should be consumed in the smallest quantity. However, per capita consumption of fish is not uniform throughout the country; and some data indicate that it is much higher in coastal areas (about twice the average) where fish of high quality is readily accessible. It is much lower in inland areas where the quality of fish available to consumers is relatively poor. It has been observed that when a consumer does not like a cereal he has purchased, he simply buys that of another brand, but when a consumer is dissatisfied with a fish purchase, he stops buying fish.

From earlier work, it was determined that the shelf life of a few seafoods held

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**Table 1.—The approximate shelf life of cod fillets (Ronsivalli et al., 1973).**

Temperature		Approximate shelf life (days)
°F	°C	
32	0	14
34	1.11	11
37	2.78	8
39	3.89	7
41	5.00	6
44	6.67	5
49	9.44	4
56	13.30	3

at 31°-33°F (−0.56°-0.56°C) is about 2 weeks from the time they are harvested. (The shelf life of a product, in this case, ends when it becomes unacceptable as a food; that is, the total time it takes for the product to change from Grade A to Grade B to Grade C and then to the point just before it becomes unacceptable.)<sup>1</sup> It has been established that the shelf life of fresh seafoods is affected mainly by the temperature at which they are held (Table 1). For example, if handling conditions are not strict and the temperature of fish fillets is allowed to rise from 32°F (0°C) to 49°F (9.4°C), the product shelf life will be reduced from 14 days to 4 days. This gives too little time for distribution, and by the time it is sold, it may well be less than Grade A in quality. Thus, the importance of temperature in the control of quality is evident. This requirement has been emphasized as has been that of packaging (Ronsivalli and Charm, 1975; Ronsivalli and Licciardello, 1976; and Slavin, 1961). While the quality of a seafood degrades relatively rapidly and must inevitably reach a stage of rejection as food, the rate of spoilage can be slowed by temperature control and protective packaging, and its quality can be measured to insure that product of poor quality is not

<sup>1</sup>U.S. Grade A means the highest possible quality with no evidence of spoilage, and having all the required product characteristics of size, shape, color, freedom from defects, etc. U.S. Grade B means that the product is of good commercial quality. It may not be as desirable in appearance, size, etc., but its eating quality (odor, flavor, etc.) is quite acceptable with only slight evidence of loss of the desirable eating quality. Grade C means fairly good quality. The product is wholesome and nutritious but may be substantially lacking in desired appearance. It may show evidence of slight to moderate changes, especially in flavor and odor, but still is free of offensive odors and flavors. Once the product shows evidence of bad odors which are usually, though not always, associated with objectionable taste, it is considered to be unacceptable, and its shelf life has ended. It should be emphasized that only U.S. Grade A products were used in this experiment, and only U.S. Grade A products are used under this concept.

sold. From the foregoing, it can be seen that in order to assure consumers that they can obtain high quality fish, it is necessary to impose strict quality control right up to the point of sale. Once consumer confidence has been gained, the effect of assured quality on the sales volume can be determined.

### CONCEPT FOR AN IDEAL PROCEDURE

The major elements of a system that brings seafoods from the sea to the consumer include: 1) fishing vessels, 2) processing plants, 3) overland vehicles, and 4) retail outlets. Other intermediate elements include warehouses, freezer rooms, etc. In all cases it is important that the temperature be kept as close to 32°F (0°C) as possible for wet fish and as cold as possible for frozen fish, certainly not higher than 0°F (-17.8°C). In addition to keeping seafoods as cool as possible, they should be handled as quickly as possible, because they spoil

at rates that are dependent on time as well as temperature. For the quality of seafoods to be reliable at retail, they must start at the highest quality, and then their quality must be maintained up to the point of sale. This can be accomplished by measuring the product quality throughout its distribution from the vessel to the retail stores and up to the day that the product is sold. The predetermination of pull dates, based on empirical data, is an effective way to insure the high quality without inflicting high inspection costs on the system. For maximum economic benefits, wet seafoods (unfrozen) could be displayed for a period during which their quality is at U.S. Grade A, removed near the end of their Grade A shelf life (about 1 week), frozen, and sold as frozen U.S. Grade A products. With this procedure, and using gas-impermeable packaging, the frozen products should remain at U.S. Grade A quality for several months to a year.

### CONCEPT IMPLEMENTATION

The concept was applied under federal coordination, and, later, it was assimilated by industry without any federal assistance.

#### Implementation of Concept Under Federal Coordination

##### Procedure

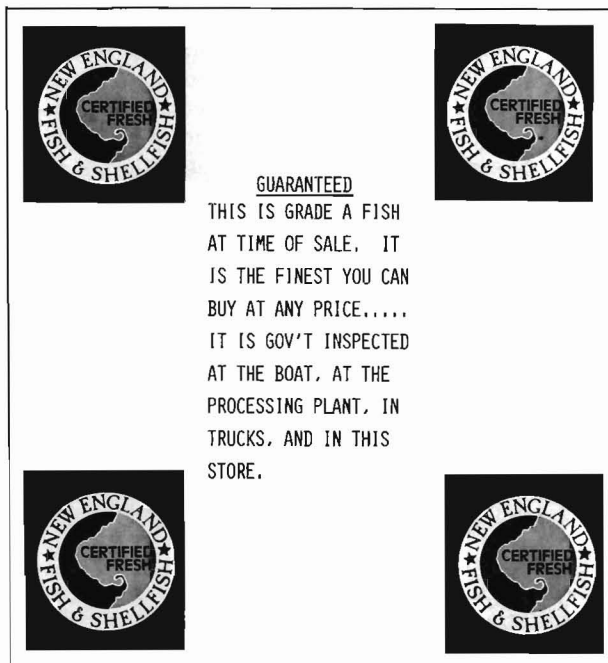
Federal technologists, inspectors, and marketing personnel collaborated with one processor and two stores of a supermarket chain to conduct the implementation of this program.

Fresh cod, cusk, flounder, haddock, ocean perch, and pollock that met the USDC Inspection Standard for Grade A were filleted at the Empire Fish Company, Inc.,<sup>2</sup> of Gloucester, a plant that is approved by the USDC Inspection Service. Fillets were inspected and packed in expanded-plastic trays containing absorbent pads and overwrapped with a self-adhering plastic film. The filled trays were labeled with the USDC inspection sticker, the U.S. Grade A symbol, and the logo identifying the product as being associated with this study (Fig. 1). The trays were packed in insulated master containers and taken by laboratory personnel to two DeMoulas supermarkets at Fitchburg and Leominster, Mass., respectively, that had been inspected and approved by USDC inspectors. At the markets the packaged fillets were weighed, priced, identified as to species, and displayed in mechanically refrigerated cases that were temperature controlled to 32°±2°F (0°±1.1°C). Surplus fillets were held in a temperature-controlled cooler at 30°±2°F (-1.11°±1.11°C) and were later used to replace units as they were sold. Temperature profiles of both the display cases and the coolers in both markets were obtained by laboratory personnel. A sign to educate potential customers to the benefits of the product was placed adjacent to the fillets (Fig. 2) and this tactic was supplemented by a 30-second oral description that was issued by tape recording every 5-10 min-



Figure 1.—The combined label used to identify products with the Grade A quality guarantee.

Figure 2.—Educational message displayed with guaranteed Grade A quality fillets.



<sup>2</sup>The names of collaborators are included only for identification. Their mention does not imply endorsement by the National Marine Fisheries Service, NOAA.

utes. An NMFS marketing specialist carried out the educational strategy which also included assistance to the store manager with recipe ideas, etc. Starting with the second or third day, the fillets were inspected daily by a USDC inspector; and when the quality of the fillets fell below U.S. Grade A, all of the remaining ones were withdrawn from sale and replaced with fresh fillets when they were available. The returned fillets were put in a freezer at the store and transferred frozen to the laboratory and held for observation to determine the commercial feasibility of converting fresh fillets to frozen fillets in their original package. Deliveries were to be made twice each week in accordance with direct requests by the chain's seafood buyer to the processor. This information was also relayed to laboratory personnel who contacted inspectors to provide them with the necessary information to set the inspection schedule. As the experiment progressed, and the Grade A shelf life of the product could be approximated, the frequency of inspection was reduced to the last few days of the expected duration of the shelf life. Laboratory personnel coordinated the entire project and checked the functions of the various elements to insure adherence to the experimental design.

#### Results and Discussion

As a result of this work, it is indicated that the concept of quality control can receive wide acceptance by the consumer, the processor, and the seller. While it is generally conceded that there is a relatively high rate of rejection of fish purchases among consumers, the most important demonstration of consumer satisfaction in this particular case was the complete absence of consumer complaints on the quality of the product during the entire 20-week period of the experiment which involved the sale of nearly 10,000 pounds (4,535 kg) of fillets of cod, cusk, flounder, haddock, ocean perch, and pollock. Consumers grew to accept the concept of quality control, even if it meant paying a higher price for product of guaranteed quality over products without guaranteed quality. At times, prices reached \$1.00 per pound (0.45 kg) more than fillets of other brands. By

the end of the experiment, it was reported that some consumers actively requested the U.S. inspected New England brand fish. They did not want regular, store-brand fish, and this was the first evidence that the buying judgment of the consumer was influenced by assured quality. As far as processors are concerned, the Empire Fish Company, which has remained with us throughout the experiment, has been and still is highly interested in the program. Other processors are now also demonstrating an interest in participating. Managers of the fish counters were unanimous in their praise for the program. They were pleased with the customer satisfaction and appearance and quality of the product. The prepackaging aspect was also highly desirable to them.

While considerable pertinent information was gained, it is not possible to quantify the effect of guaranteed quality on the sales volume because deliveries were unable to keep up with the demand. Nor was it possible to make any determination concerning the potential demand. As can be seen from Figure 3, there were no excesses in some cases. The amount of fillets that was returned (returns) varied greatly and erratically, ranging from a maximum of 422 pounds (about 191

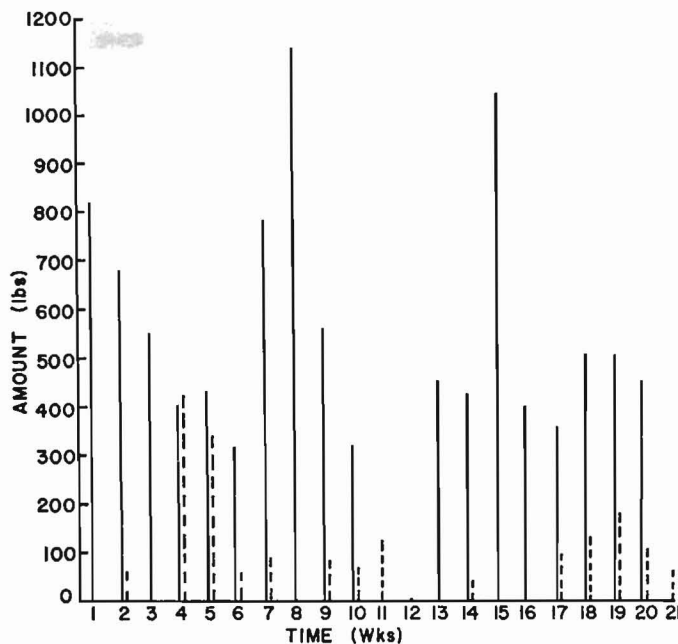


Figure 3.—Deliveries (solid lines) and returns (broken lines) of fish fillets.

Table 2.—Schedule of deliveries and returns of Grade A fillets of six species of fish to two retail stores (in pounds).

Week	Delivery	Returns	Sales
10(18-22)76	820	0	820
(25-29)	680	58	622
11(1-5)	560	0	560
(8-12)	400	422	<sup>1</sup> -22
(15-19)	440	315	125
(22-26)	320	46	274
11/29-12/3	780	89	691
12(6-10)	1,150	0	1,150
(13-17)	550	84	466
(20-24)	320	64	256
(27-31)	0	126	<sup>1</sup> -126
1(3-7)77	0	0	0
(10-14)	460	0	460
(17-21)	430	38	392
(24-28)	1,050	0	1,050
1/31-2/4	400	0	400
2(7-11)	360	89	271
(14-18)	510	132	378
(21-25)	510	172	338
2/28-3/4	460	106	354
3(7-11)	0	82	<sup>1</sup> -82
	10,200	1,823	8,377

<sup>1</sup>The negative values included units from prior deliveries that were not picked up earlier.

kg) to 0 pounds per week. An apparent anomaly in the figure is the high rate of returns on the fourth and fifth weeks, but this is explained by the fact that the returns were from prior deliveries (e.g., the first and second weeks), and were not picked up earlier. Although one can detect much less than a trend, returns were proportionately higher at the beginning than at the middle or the end of the experiment; the largest deliveries were not followed by large returns—see Figure 3 and Table 2. Indeed, large

deliveries were associated with consistently low returns. In general, returns were associated with the level of store prices. When prices stood at their lowest (e.g., during special sales), returns were negligible or nil. This was true especially for cod, cusk, and haddock. For ocean perch and pollock this relationship was not evident in the beginning, but it became evident toward the middle of the experiment. For flounder, the case is more difficult to determine. The lowest price occurred at the end of the phase and it had only one incidence. The relationship between high prices and high returns also appears to exist, but it could not be clearly determined from available data. A more complete understanding of these relationships would also require comparative data for meat and poultry. Besides, the sale of fish is clearly a function not only of price but also of quantity. Given the existence of a wide socioeconomic spectrum of customers, one can sell a low amount of fish at almost any price, but to sell a large quantity is another matter.

The introduction of underutilized species was expected to be facilitated if consumer confidence in the New England brand fish could be gained. The data collected in this experiment showed that this expectation is premature. There was three times as much haddock sold as there was cod, even though educational information was provided on the eating and nutritional similarities of cod to haddock, and even though cod generally sells for less than haddock. Cusk, which was cheaper than the more familiar species, hardly moved by comparison with the others (less than 2 percent of the total sales), and much of the cusk (about 43 percent) had to be returned. It appears that consumers purchased on the basis of species. Thus, we should not expect that underutilized species will sell as readily as conventional ones until consumer confidence in a brand starts to influence their buying judgment. Quality differences among displayed products might then become more important than species differences.

In order to capitalize on the strategy of freezing the product just before the end of its Grade A shelf life, it was necessary to know whether the product

could simply be frozen in its original package (designed for maximum protection of the product whether frozen or unfrozen), or whether a repackaging step in the process—a costly step—was required. This aspect was studied in a limited way and the results obtained thus far show that freezing in the original package is a definite possibility. Both the tray and the packaging material retained their physical and aesthetic properties. The price label appeared shopworn, but it normally would be covered or replaced with a new price label. The inspection seal and Grade A label held up very well. There was some frost formed on the inner surface of the plastic overwrap, but it did not detract from the product which retained its original appearance. On thawing, the frost disappeared, and both the package and its contents had the same outstanding appearance and quality that have characterized this product throughout.

#### **Implementation of Concept by Industry (Independently from Government)**

A few months after this federally coordinated experiment was initiated, the Empire Fish Company and the First National Stores supermarket chain entered into an agreement (independently from government) to conduct a pilot operation involving five randomly selected stores and 200 pounds (about 91 kg) of fish fillets per week. Except for laboratory participation, the procedure used was the same as described above, and this independent effort adopted most of the quality control techniques embodied in the concept developed by the federal effort. From that exploratory step, the enterprise grew, and at last report, the Empire Fish Company was supplying about 200 First National supermarkets a total of about 15,000 pounds of fillets per week—and both the number of stores and the volume of product were still growing.

If the concept becomes assimilated

by industry on a large scale, a number of long range benefits are possible and ultimately accruable to the consumer. Among these, the markets for high quality seafoods should expand to inland areas where a demand for these commodities already exists to a degree; a tendency to update and improve plants, vessels, and equipment would be generated; and higher levels of investment would be encouraged, especially with the new opportunities possible under this country's extended fisheries jurisdiction to 200 miles (124 km) and the relatively recent emphasis on the dietary benefits of fish.

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