QUALITY CONTROL & QUALITY ASSURANCE FOR SEAFOOD

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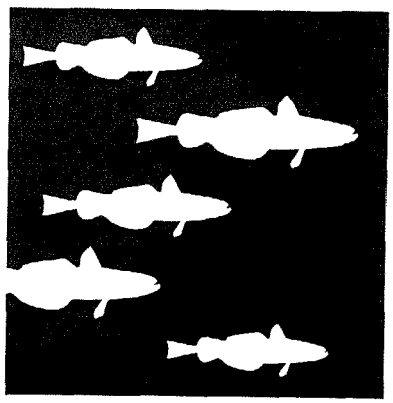

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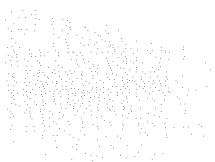

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PREFACE

Controlling and improving seafood quality is one of the foremost challenges confronting the world' s seafood industries. Seafoods can be considered delicate and highly perishable "commodities" like other foods, but many - - plex quality issues result from conditions unique to this industry. For example, most seafoods aren t raised under controlled conditions from a few cultivated breeds, but are hunted and captured from thousands of publicly managed wild stocks and species. These conditions complicate efforts to standardize product quality, particularly in comparison to Competing industries that use animal husbandry techniques (including aquaculture). Commercially harvested seafoods are also captured at long distances from processing and distribution centers. Variability in supply and quality due to natural variation in these wild creatures, and problems arising from public management of the resource, complicate quality problems. The risk and uncertainty associated with this variability often make it unprofitable to invest in the capital and human resources necessary to improve product quality. Providing products that consistently satisfy consumer demand and enhance market opportunities is therefore a difficult and daunt ing task for many sectors of the industry.

Many of the firms that process products from the assemblage of codlike fish known as hakes and whitings are particularly vulnerable to these problems. Although these species are spread across every major ocean and have diverse life histories, they share two intrinsic characteristics that significantly affect final product quality: a relatively soft flesh and infestation of parasites, including myxosporidean parasites. These parasites are not only unsightly, but are often associated with high levels of protease enzymes. These enzymes can result in a soft texture and contribute to bruised or mushy flesh, rapid rancidity, and reduced shelf life.

Among all species of hakes and whitings, none may be characterized by a greater combi-nation of preharvest product quality problems than Pacific whiting ***(Merluccius productus),*** found off the west coast of the United States and Canada. Until recently, poor final product quality resulted, and market prices were too low to generate profits. Prior to 1991, the vast majority of the stock was harvested by foreign and joint-venture vessels delivering to processing ships from Europe and Asia. Domestic use of whiting grew from 20,000 metric tons (mt) in 1990 to over 200,000 mt in 1991 because of increased prices for various product forms and an expanding west coast fishing and procesing fleet. Pacific whiting, with potential allo$_w$-able biological harvests of 200,000 to 500,000 mt, is now considered "fully utilized." The 1992 season showed a dramatic increase in shore-based investment in processing facilities; it is estimated that 75,000 to 100,000 mt of Pacific whiting will be processed shoreside in 1994 (the remaining 140,000 mt will be processed a at sea).

This rapid transformation to domestic processing has compounded difficulties in understanding and controlling the quality attributes that critically affect the value of whiting products. A better understanding of the inherent characteristics of Pacific whiting and how they affect final product quality and market development is crucial for the development of a sustainable, profitable industry.

Given the size of the resource and its product quality problems, a considerable amount of private and public effort has been expended to understand biological, technical, and marketing problems. Conferences on Pacific whiting were held in Astoria, Oregon, in 1990 and again in Newport in 1992. In late 1992, Oregon fishers and seafood processors joined together to form the Pacific Northwest Seafood Association (PNSA). One of the primary objectives of the association was to establish guidelines for controlling and improving Pacific whiting quality. Association members recognized that there were a number of organizations, seafood marketing associations, and government agencies that had established seafood quality standards. They also understood that "official" programs such as HACCP, IS0 9000, and TQM were being proposed for implementation at gional, national, and international levels. The association believed that it would be beneficial to learn from the individuals, firms, industry groups, and regional or national governments that had spent years wrestling with the problem of managing seafood quality.The PNSA therefore asked the organizers to plan a conference that would gather U.S.and international

experts to share their experiences and knowledge, in order to guide the Pacific whiting industry in developing its own successful quality assurance programs.

The conference was designed to cover a range of topics and to highlight the relationships between production, marketing, and quality management strategies. Topics covered were (1) the status and evolution of national and international seafood quality standards, (2) the "buyer's" perspective on quality assurance, (3) seafood associations and the role of quality standards, (4) measuring and controlling seafood quality, (5) designing and managing quality assurance programs, and (6) quality assurance as a tool in marketing management programs.

As conference organizers, we were extremely pleased by the quality of the speakers and their active participation in round table discussions as well as question and answer sessions. We were also gratified to see the commitment to seafood quality demonstrated by many of our colleagues, including fishers, processors, marketers, and researchers. We felt fortunate to have so many experts from regional, national, and international arenas who could provide us with insights from their experience and research.

One of the missions of both Oregon State University's Coastal Oregon Experiment Station and the International Institute of Fisheries Economics and Trade is to transfer information on managing marine resources and marine resource-based industries to the public and private sectors where it can be used. We feel that this conference and its proceedings serve this purpose and provide the industry with some unique insights into quality control and quality assurance programs for seafood.

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ABBREVIATIONS

AFAQ-Association Francaise pour l'Assurance Qualite (the French Quality Assurance Association)
ANSI-American National Standards Institute
AOC-Appellation d'Origine Controlee (specified origin label, France)
ASMI-Alaska Seafood Marketing Institute
ASP-amnesic shellfish poison
ASQC-American Society for Quality Control
ATP-adenosine triphosphate
CAC-Codex Alimentarius Commission
CCP-critical control point
CFR-Code of Federal Regulations
CP-control point
DFO-Department of Fisheries and Oceans (Canada)
DSP-Division of Seafood Programs (OS)
EC-European Community
EEC-European Economic Community
ESOP--employee stock ownership plan
FAO-Food and Agriculture Organization (UN)
FD&C-Food Drug and Cosmetic Act of 1938 (U.S.)
FDA-Food and Drug Administration (U.S.-HHS)
FSIS-Food Safety and Inspection Services (USDA)
FTA-Free Trade Agreement (U.S.-Canada)
FWS-Fish and Wildlife Service (U.S.)
GATT--General Agreement on Tariffs and Trade
GMP-good manufacturing practice
HACCP-hazard analysis and critical control points
HHS-Department of Health and Human Services (U.S.)
IQF-individually quick frozen
ISO-International Standards Organization
MF-Ministry of Fisheries (Norway)
MOU-memorandum of understanding
MSSP-Model Seafood Surveillance Program (NOAA)
NACMCF-National Advisory Committee Microbiological Criteria for Foods
NAS-National Academy of Science (U.S.)
NFFSO-Norwegian Fish Farmers' Sales Organization
NFI-National Fisheries Institute (U.S.)
NMFS-National Marine Fisheries Service (U.S.)
NOAA-National Oceanic and Atmospheric Administration (U.S.)
NSIP-National Seafood Inspection Program (U.S.)
OIE-Office of Epizootics-health and sanitary requirements for the import and export of animals (U.S.)
OS-Office of Seafood (U.S.-FDA)
PC-production capacity
PO-producer organizations
PSP-paralytic shellfish poison
PUFI-packed under federal inspection
P-production
QA-quality assurance
QMP-Quality Management Program (Canada)
RAB-Registrar Accreditation Board
RNE-Reseau National d'Essais (National Testing Network, France)
SIFE-Sanitarily Inspected Fish Establishment
SPC-statistical process control
STP-sodium tripolyphosphate
TQM-total quality management
TRQ-Tariff Rate Quota
UN-United Nations
USDA-U.S. Department of Agriculture
USDC-U.S. Department of Commerce
WHO-World Health Organization

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REPORT FROM THE OFFICE OF SEAFOOD: AN ISSUES UPDATE

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GLOBAL PICTURE

In the United States, consumers eat about 1,000 commercial species and spend about $30 billion annually on seafood. Every year the U.S. exports approximately $3 billion of its harvest and imports approximately 200,000 seafood entries from 135 countries, worth about $5 billion.

Nutritionally, seafood contributes to a healthful diet as a source of high-quality protein, certain vitamins and minerals, and essential fatty acids. Consumers have come to depend on seafood as a protein source in their quest for low-fat, low-cholesterol diets: consumption has increased in the last decade to almost 15 pounds a person. It is evident, then, that seafood is an important commodity in the U.S. diet and a significant contributor to the GNP and world trade.

OFFICE OF SEAFOOD

The Food and Drug Administration's (FDA) Office of Seafood is a little over two years old and in that brief period has accomplished much that will serve as the springboard to improving and assuring the safety of seafood.

In remarks at the March 22,1993 National Food Policy Conference, David Kessler, Commissioner of Food and Drugs, said that if we food regulators are going to ensure the safety and wholesomeness of the U.S. food supply, we can't do the job the same way we were doing it 25-or-even 10-years ago. We cannot afford to march in place.

We need to recognize that the food industry and consumption patterns have changed dramatically. The Pacific whiting surimi industry is a good example.

FDA SEAFOOD PROGRAM

In the face of these changes in the production and consumption of food, consumers continue to ask the same two simple and legitimate questions: "Is the food safe to eat?" and "What are you doing to make it safe?"

It is not that the public expects assurance that food is absolutely safe. But it does expect that a system is in place to ensure that food is as safe as we can possibly make it-a system that is responsive to today's realities, today's risks, and today's consumer expectations.

Seafood, like many other foods, poses a wide array of potential health problems, most of which never occur. Data indicate that the rate of illness from seafood is extremely low and on a per pound consumed basis, is declining.

Some problems, however, do arise because of pathogenic bacteria and viruses: natural toxins, like domoic acid along the Oregon coast; chemical contaminants; parasites; decomposition; and drug residues.

The changing conditions and increasing technological advances in the seafood industry are typified by the areas of aquaculture engineered seafood (surimi) and vacuum and modified atmospheric packaging. These changes and resultant demands are not unique to the seafood industry. The fundamental ways in how we produce, distribute, and consume food have changed since the basic elements of today's food safety system were put in place. The Office of Seafood is in the forefront of FDA efforts to respond to these new issues and challenges which it sees not as obstacles, but as opportunities.

STRATEGIC PLAN FY 93-98

The Office of Seafood has recognized that conducting inspections, gathering samples, and running laboratory analyses and research were not sufficient to protect the consumer from all potential hazards. This recognition has resulted in a different perspective on seafood safety. The new perspective is reflected in a draft strategic plan that is in its final formative stages and that will reflect suggestions from the industry, state and local agencies, scientists and consumers. Our intention with this plan is to create complete consumer confidence in all seafood.

The strategic plan sets four strategic goals They are to ensure the following:

1) that seafood products are safe
2) that seafood is wholesome and properly labeled
3) that the FDA, industry, and consumers have accurate information concerning seafood
4) that the infrastructure exists to accomplish 1,2, and 3 above

We are achieving these goals, as I will show, through specific activities and new initiatives in the seafood arena.

ECONOMIC FRAUD

Economic fraud is of sufficient complexity that it can occur even among members of the seafood industry who are most knowledgeable about the products and trade practices. This problem has been targeted as a major concern by Commissioner Kessler, who has been applauded by the industry for his efforts. First, the FDA's budget for work in this area has been doubled. Second, over 1,000 letters have been sent to the industry warning against overglazing. Third, a number of actions have been taken against species substitution, including Pacific rockfish substituted for red snapper, pollock for cod, oreo dory for orange roughy, and some freshwater species for saltwater species. The FDA has been much more active in this area over the past two years, and it intends to continue to vigorously pursue action against these and other types of economic fraud.

SCALLOPS AND PHOSPHATES

Fresh sea scallops are 75 to 79 percent water. They may lose considerable moisture after shucking; however, this loss may be prevented by treatment with sodium tripolyphosphate (STP). There is even some indication that STP may help preserve desirable eating characteristics.

However, it turns out that prolonged soaking of scallops in STP solutions results in the scallops' taking up excess water. And unfortunately, some scallop processors have been taking advantage of this to enhance product weight and their profits. Selling this excess water at the price of scallops constitutes economic fraud.

INTERIM LABELING POLICY

After some people in industry expressed their frustration and concern to the FDA, we responded by setting an interim labeling policy for scallops based on water content. This policy was designed to ensure fair play within the industry and a fair product for the consumer,

Specifically, the policy is that scallops that have been treated with STP and have picked up water must be labeled with the identity statement, "X percent of water-added scallop product." This labeling must be used with any scallop with 80 to 84 percent water. In addition, the statement "Processed with Sodium Tripolyphosphate" or any other phosphate that might be used must appear on the label; and the phosphate(s) and added water must be in the ingredients statement. No scallops containing greater than 84 percent water will be allowed on the market.

In other words, untreated scallops with 79 percent water or less are to be labeled "scallops." Any product with 80 to 84 percent moisture should be labeled as scallop product, and anything over 84 percent moisture cannot be marketed.

This policy will remain in effect until the agency completes an evaluation of the additional data recently provided by industry. The data concern the relationship between the normal moisture content of freshly shucked scallops and their treatment, as well as the possible loss of key nutrients.

PROBLEMS WITH CRAB

Blue Crab

It has been FDA policy for decades that product labeled "crab meat," with no qualifications, must be derived from the blue crab. There have been some complaints from the blue crab industry, however, that imported, less valuable crab meat from other species is being substituted for blue crab and labeled as "crab meat," with no regard for our policy and requirements. In addition, some companies are ignoring the U.S. Customs Service's labeling requirement for country of origin. We are working closely with the U.S. Customs Service and other agencies on this problem. One firm has already been prosecuted for this illegal practice in the State of Maryland.

Dungeness Crab

The west coast has certainly had more than its share of problems in the last few years with domoic acid and the saxitoxins, associated with amnesic shellfish poison (ASP) and paralytic shellfish poison (PSP), found in the vis-

cera of Dungeness crab. Again, the FDA has established a policy and is taking action against crabs found to have 30 or more parts per million (ppm) domoic acid in the viscera; or 80 or more micrograms per 100 grams saxitoxin in the viscera. This 30 ppm is a recent revision upward from a previous level of 20 ppm, based upon new data provided to our Health Hazards Evaluation Board. These toxins also have affected the harvest of west coast razor clams. PSP in razor clams must be below 80 micrograms per 100 grams; domoic acid must be below 20 ppm, or the beds are closed to harvest.

CONTAMINANTS

Chemical Contaminants

The presence of chemical contaminants in seafood-both marine and freshwater species - is often a regional issue. The FDA's role is to determine allowable levels for products entering interstate commerce. Because we recognize that regional concerns may not be effectively addressed by national controls, we have been working on guidance documents that local health authorities can use to issue advisories or close areas to both commercial and recreational fisheries.

Contaminant Limits for Shellfish

Four of these guidance documents have been issued for contaminants of shellfish (including molluscan and crustacean shellfish). The contaminants are arsenic, nickel, chromium, and cadmium. Documents for other contaminants are under development and, following review by a subcommittee of the Association of Food and Drug Officials, will be issued.

National Conference

In April 1993, the FDA hosted a two-day conference in Washington, D.C., on chemical contaminants in seafood. The purpose was to draw together state regulatory agencies, industry, scientists, other federal agencies, and interested consumer groups to share information on current and planned efforts to assess the risk of chemical contaminants in seafood. Participants also discussed how to manage these risks and how to go about communicating to the world what the risks really are. Our meeting was hailed as a new paradigm in risk communication. This meeting will go a long way in helping us in FDA to focus our resources.

Color Additives

When canthaxanthin was approved for coloring food directly and through chicken feed, it was not the agency's intent to permit its use as an additive to fish feed, although we did not explicitly prohibit it. This ambiguity has led to some confusion in the aquaculture industry and in the agency.

Petitions for the use of canthaxanthin and astaxanthin are in varying stages of submission and review, These and other color additives may be present in fish products, and regardless of whether they are added directly or through the fish feed, or whether they are of natural or synthetic origins, they are artificial colors and any labeling must state that color has been added.

LISTERIA

The problem with *Listeria* in seafood remains difficult Our current policy is that if we detect it, we take action. The focus here is with ready-to-eat products such as smoked fish and surimi that will not be cooked sufficiently by the consumer.

INSPECTIONS OF HIGH-RISK PRODUCTS

As a follow-up to limited inspections of virtually the entire domestic seafood processing industry completed over a year ago, we have conducted more in-depth inspections of producers of

1) ready-to-eat products
2) products in modified atmosphere packaging
3) products from scombrotoxic species, such as tuna, mahi mahi, and amberjack
4) some specialty products likely to have high microbial loads

These inspection surveys have been a great help in providing us with an overview and understanding of the latest industry practices and in targeting for future activities.

Firms processing these types of products, often referred to as "high-risk" products, are now inspected on an annual basis.

HACCP INITIATIVE

I mentioned earlier that both the food industry and consumption patterns have changed drastically in the last decade. The American consumer relies now on foods produced in high-tech, centralized processing facilities, shipped

over long distances, and packaged and stored in new ways. For a number of reasons, the opportunities for food-borne illness have increased. The consumption of prepared foods sold ready-to-eat at retail outlets is expanding rapidly. There are more steps between the harvest site and the kitchen table, more steps in processing, and greater distances of transport. As a result, there is more opportunity for food to be contaminated. Furthermore, new pathogens have appeared, there has been an increase in the incidence of industrial chemicals and environmental contaminants, and certain human subpopulations are now at higher risk than others.

Unfortunately, the FDA's current system of monitoring the food supply has not kept up with the technology. As Commissioner Kessler has said, our current system of food safety regulation is piecemeal and reactive. What we need now is a system built on preventing problems. That system is HACCP.

HACCP stands for hazard analysis critical control points. It was adopted for mandatory federal control over the processing of low-acid canned foods over 20 years ago and has been an unqualified success in an industry sector that was fraught with problems. HACCP has been endorsed by the World Health Organization, the Food and Agriculture Organization's Codex Alimentarius, and the National Academy of Sciences (NAS). The 1991 NAS report, *Seafood Safety,* recommended that HACCP be applied to the seafood industry.

HACCP DEFINITION

HACCP is a system of preventive controls by which food processors and handlers evaluate the kinds of hazards that could affect their products, institute controls to prevent those hazards, monitor the performance of these controls, and maintain records of this monitoring of routine practice. It puts industry squarely into the driver's seat of preventing public health hazards.

Government's role, of course, is one of verification-through inspection, examination of records, sampling and analysis, if necessary-to make sure industry has done its part.

The FDA has developed a draft regulation requiring that industry apply the kinds of controls that will enhance consumer confidence in seafood. The draft is currently under review by our general counsel. We hope to publish soon.

FDA/NOAA VOLUNTARY SEAFOOD PROGRAM

In cooperation with the National Marine Fisheries Service of the National Oceanic and Atmospheric Administration (NOAA), we have designed a voluntary, fee-for-service inspection program, based on HACCP concepts. It may serve as an adjunct to our already existing inspection programs, both of which are being transformed to a HACCP-based approach. We have conducted pilots for domestic seafood processors, foreign processors, and retailers. We are currently piloting one for food service facilities. Publication of the proposed regulation on this program has been delayed pending completion of my agency's mandatory HACCP initiative. In the meantime, NOAA is shifting its program for processors to a HACCP-based approach as well.

IMPORTS

We have recently adopted a new strategy for dealing with imported seafood. This strategy includes

1) much closer cooperation with state and local authorities to identify imports that reach the retail market
2) the initiation of civil and criminal actions against consistent and flagrant violators
3) short-term inspection surveys targeting specific products categories
4) education of importers, brokers, and foreign processors

At the same time, we think that importers must do a better job, they must be more responsible to make sure the products they import meet our requirements.

Another aspect of the new import strategy that holds great promise is to give priority to the establishment of memoranda of understanding (MOUs) with countries that, because of their own inspection systems, consistently ship acceptable products to the U.S. This philosophy will facilitate the entry of products from countries that export safe, wholesome, properly labeled products and will permit us to direct our resources to the inspection of products of concern from other countries.

IRRADIATION

Irradiation of seafood to reduce microorganisms is approved for use in 35 countries. If

properly used, it can give the consumer a higher quality, as well as a safer, product. The FDA is reviewing petitions to permit application of this technology to U.S. seafood products.

We are already receiving inquiries about the technology from consumers. Clearly, there is a need for greater consumer education to achieve acceptance and understanding. Industry and government must work together to prevent misuse of the technology and to promote public understanding. We believe the petition process is the key.

DECOMPOSITION

Decomposition is a leading cause of complaints about seafood. Besides its aesthetic effects, decomposition may also be a direct health threat; scombrotoxins are a prime example. We have been putting much effort into this area. Analyses for decomposition in seafood-fresh, frozen, and canned products, domestic and imported-have been increased significantly. We're trying to improve the consistency of detection of decomposition, through both microbiological and chemical indicators. To date, the microbiological indicators have not panned out as well as the chemical indicators.

We are putting together a plan to set a defect action level for histamine in all scombroid fish, and a 1 ppm cadaverine action level for mahi mahi, tuna, and other fishery products. We are also looking at the implementation of a pass-fail system rather than the current three-class system for organoleptic assessment of decomposition,

RESEARCH

I can't describe the activities of the Office of Safety without talking about our research program. The FDA's seafood research is directed toward understanding the nature and severity of risks in seafood and finding the means to control those risks. We believe we need a solid scientific base from which to make sound regulatory decisions, address new problems, and perform inspection activities.

Our scientists develop or evaluate the tests or methods used to determine if seafood has been prepared, packed, or held under unsanitary conditions and to ensure that it is not contaminated with filth or rendered injurious to health. The scientists design these tests not only to determine the presence of biological and chemical contaminants in seafood, but also to assess what effects chemical contaminants and toxins have on biological systems, how specific pathogens cause disease, and whether economic fraud has occurred.

A recently completed inventory indicates that there are over 180 ongoing seafood research projects directly related to safety. They fall into three general areas:

1) biological hazards, including the natural toxins--algal toxins and toxins arising from decomposition
2) microbiological hazards-bacteria, viruses, and parasites
3) chemical hazards

Research is also being done in the areas of economic fraud, exposure, consumption patterns, and occurrence of illness.

The FDA wants to lead the nation in coordinating seafood research, it also intends to work hand-in-hand with industry, other federal agencies, state and local authorities, private groups, and the international community to ensure and promote seafood safety.

The FDA is in the hazards management business. We conduct research in hazard analysis, risk assessment, and the development of risk management strategies. All are designed to provide sound, up-to-date information to the industry, to educate the consumer, and to develop regulations and standards.

SEAFOOD HOTLINE

Last, as part of our comprehensive educational program on seafood safety, we have established a 24-hour seafood hotline to provide information to consumers and industry. The hotline number is l-800-FDA-4010. In the Washington, D.C., area, the number is (202) 205-4341.

Our hotline allows callers to request FDA seafood publications, listen to pre-recorded seafood safety messages, and access other information. Between 12 noon and 4 p.m. EST, Monday through Friday, FDA consumer affairs specialists are available to answer calls directly and to return earlier calls that need personal attention. Information can even be flash faxed using this system.

In its first six months, the hotline received almost 10,000 calls. Inquiries have ranged from purchasing, storing, and handling, to safety, labeling, and preparation.

GET HOOKED ON SEAFOOD SAFETY

There is a lot on our plate at the Office of Seafood, but with the help and cooperation of groups such as this, we have every confidence that together we can face the challenges and develop new ways of thinking, new approaches, and a new dedication to food safety.

National and International Perspectives on Seafood Quality

TRENDS IN SEAFOOD QUALITY ASSURANCE

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INTRODUCTION

The issue of seafood quality is becoming increasingly complex. Consumers want more than safe and wholesome food-they want consistent and high quality. Fishers and processors must meet these changing demands and realize that harvesting and processing using traditional practices or simple "rules of thumb" are inadequate to meet evolving international standards for seafood quality. Every country incorporates minimum safety standards into import regulations, which processors routinely meet and generally exceed. The problem lies in knowing the level of quality beyond simple "safety" that must be met to improve profits and create new market opportunities. Contemporary consumers demand a level of quality that is costly to produce. However, depending on the market, "excess" quality will increase costs and decrease profits. Both exceeding and not meeting optimal quality will lead to lower profits.

Seafood producers are familiar with the technical aspects of quality control and are accustomed to adapting to technical problems as they arise. Today, however, quality assurance means more than identifying belly burn and tearing down seams. To succeed in the highly competitive food protein market, the seafood industry must address a wide range of issues related to public regulations, consumer behavior, and product quality. Adaptability is a necessary element of good management. The objectives of this paper are to summarize the latest trends and issues in seafood safety and quality in the United States and internationally. The first sections of the paper describe U.S. programs and agency responsibilities. The remaining sections outline international programs, particularly those being developed by the European Community (EC). The paper concludes with a discussion of implications for the U.S. industry.

SEAFOOD INSPECTION

American seafood producers are routinely inspected by the government for food safety issues. Plants are also regularly visited by various buyers, each with individual needs and specifications.

A prominent topic in the seafood industry is whether inspections will become "mandatory." This is somewhat misleading because the U.S. Food and Drug Administration (FDA) has had a mandatory inspection program for many years. Where confusion lies is that the inspections for seafood are periodic, unlike those for beef and poultry, which require the continuous presence of a U.S. Department of Agriculture (USDA) inspector in the plant.

The newest plan of the FDA is to continue its periodic inspection with modifications, including the incorporation of the hazard analysis and critical control points (HACCP) program, as discussed below. The broad outline for this plan was announced March 22, 1993 by FDA Commissioner David Kessler. The periodic plant inspection has always included certain records and will now add a HACCP plan. HACCP training workshops are available through the National Marine Fisheries Service (NMFS) and various industry groups. These workshops should provide adequate training for designing a HACCP plan, but each plan will be individually reviewed by the FDA. The FDA plan has been drafted and is under review by the Department of Health and Human Services (HHS). After leaving HHS, the plan will be reviewed by the Office of Management and Budget, then published for public comment. A publication date of late 1993 is predicted. There will be a substantial period of up to a year for implementing the FDA-mandated HACCP program (Billy 1993; Lowell, personal communication).

HACCP

Hazard analysis and critical control points is a method of proactive and preventative inspection. The traditional system of inspecting only the final product can be extremely wasteful of both materials and labor. In contrast, the HACCP system is designed to identify critical areas in the plant and monitor those points during processing, which allows the quality assurance personnel to find problems where and when they occur. This technique has been used successfully in many industries, notably low-acid canning of seafood. The function of the HACCP program primarily is safety rather than quality (Pierson 1992).

Producing a HACCP program requires familiarity with the workings of the plant and then tailoring a plan on the basis of that information. Many agencies have their own versions of HACCP checklists. For example, the USDA uses the checklist of the National Advisory Committee on Microbiological Criteria for Food, and the Codex Commission has its own list. With slight variations, each list consists of

1. the personnel to be involved with the procedure
2. construction of a product flow diagram for the plant
3. the control points, potential preventative measures, and establishment of target levels and tolerances at each critical control point ("critical" referring to possible consumer health hazards resulting from loss of control at this point)
4. the monitoring system, documentation systems and procedures to address process deviation
5. the review system

The FDA and the National Oceanic and Atmospheric Administration (NOAA) have been collaborating on developing regulations and a manual for a HACCP-based inspection program targeting (1) food safety, (2) food hygiene, and (3) economic fraud. According to Lu Cano of the FDA, this was to be accomplished by the end of 1993, but as of August the project had been halted to reconsider its necessity as an addition to the other programs (Cano, personal communication).

NOAA began operating a HACCP-based inspection system in July 1992, which is a fee-for-service program. NOAA administers three types of inspection programs: heavy inspection, occasional inspection, and HACCP-based self-inspection. The three vary in cost. The NOAA programs result in inspection certification which, according to Thomas Moreau of NMFS Technical Services, will be adequate for export of product to the EC. The certificates will be available in nine languages to expedite exportation procedures (Moreau 1993).

Over the years many mandatory seafood inspection bills have been introduced in Congress but have not been passed. The 1992 Congress examined two bills, neither of which made it out of committee. No new seafood inspection bills have been submitted to the 1993 Congress., although there is a shellfish water bill-HR1412-sponsored by Jolene Unsoeld, a Democrat from Washington. The interest in creating seafood inspection legislation has been decreasing because of difficulties in developing congressional consensus on (1) the choice of agency to administer the new law, (2) protection of whistle blowers, (3) a new definition of "adulteration" in the federal Food, Drug, and Cosmetic Act of 1938, and (4) the origin of the funding.

The FDA predicts that their HACCP-based inspection will be a sufficient program for meeting safety and export needs. The FDA believes that the program will require minimal additional effort from industry and incur no extra cost to the FDA.

UNITED STATES AGENCIES

There are three U.S. Executive Branch cabinet posts directly responsible for dealing with contaminants in seafood: the Department of Health and Human Services, which houses the FDA, the Department of Commerce, within which NOAA administers NMFS; and the Department of the Interior, which contains the Fish and Wildlife Service.

FDA-Office of Seafood

The U.S. FDA administers the Food, Drug, and Cosmetic Act through the use of random inspections.

In February 1991, David Kessler created the first product-specific office in the FDA: the Office of Seafood (OS), contained in the FDA's Center for Food Safety and Applied Nutrition. The OS attempts to address the most serious problems associated with seafood consumption, which it defines as water quality, exports, imports, retail, and consumer concerns. The OS comprises two divisions:

1. The Division of Seafood Research, which plans and conducts research on (a) seafood harvesting and processing and (b) storage and

distribution of wild and farmed sources that may be affected by chemical and biological contamination.

2. The Division of Seafood Programs, which is responsible for agency policies, planning and coordinating all seafood inspection, and enforcement. The Division of Seafood Protection is further broken down into (a) policy guidance, (b) program and enforcement, and (c) shellfish sanitation.

The current strategy of the FDA is to become more effective by aiming for prevention. However, there are two problems with this more aggressive strategy: the difficulty of identifying future problems and the tendency to undertake a wider scope of responsibility than was originally intended - for example, the monitoring for ocean contaminants that could affect seafood safety. The FDA justifies this broadening of responsibility as necessary for the protection of consumers against the production and trade of adulterated goods. The FDA uses several methods of protection:

1. creating minimum tolerance levels
2. monitoring water quality in shellfish harvest areas
3. developing simple field tests for toxins
4. compiling data from other organizations on chemical contaminants
5. analyzing species susceptibility to pesticides and chemicals
6. requiring the incorporation of a HACCP program for seafood processing plants

NOAA-NMFS

The National Oceanic and Atmospheric Administration is a branch of the U.S. Department of Commerce. The National Marine Fisheries Service, under the directorship of NOAA, offers several fee-for-service inspection programs. These inspections may be used to supplement the FDA-required inspection either when buyers require an independent grading system or when an inspection is needed sooner than the regularly scheduled FDA inspection.

There are several different auditing frequencies that lead to different approval marks. "U.S. grade A,," required by some buyers, is achieved through a heavy inspection system. "Packed Under Federal Inspection" (PUFI) is the general NOAA inspection mark. "Sanitarily Inspected Fish Establishment" (SIFE) inspection focuses only on plant sanitation and includes no product qualifications. "Lot Inspected" is an inspection of samples of entire lots.

NMFS has written Model Seafood Surveillance Programs (MSSP) for various seafood businesses. MSSP is a guideline for building a HACCP program. MSSP subjects covered are aquaculture, breaded and specialty items, food service/consumers, imported products, plan of operations, raw fish, retail, smoked and cured products, and wholesale distributors.

In July 1992 the U.S. Department of Commerce announced the incorporation of HACCP into its inspection program. Completing a HACCP workshop is mandatory by at least one employee in a company wishing to use the NMFS inspection service. Training is provided through NOAA workshops and several industry groups. Along with the inspection services, NMFS is working on joint training between the FDA and the Department of Fisheries and Oceans of Canada, in a move to harmonize trade between Canada and the U.S.

U.S. Department of Agriculture - FSIS

The USDA oversees other protein foods besides seafood through the Food Safety and Inspection Service (FSIS), which uses a comprehensive continuous inspection program in all meat and poultry plants.

The National Fisheries Institute (NFI) preference for administrator of a continuous seafood inspection is the FSIS (Richard Gutting, personal communication). At the suggestion of the National Academy of Science, the current continuous inspection in the meat and poultry industries would be changed to a HACCP random inspection program that would free up some of the program's labor to include seafood. The reason the NFI prefers the USDA is that the cooperative international inspections are already in place for meat and poultry importation. However, this preference may be reconsidered in light of the recent *E. coli* outbreaks in the Western United States.

The United States, along with Guam, Puerto Rico, and the Virgin Islands, falls under the jurisdiction of the Code of Federal Regulations Part 21 when dealing with the transportation and inspection of seafood and CFR 50 when dealing with fishery products. Many states have additional regulations, tailored to regional production, that are slightly more restrictive than the Federal regulations.

ISO 9000

With increasing international trade in seafood and other goods, the need for uniformity among quality systems has also increased. This need has been addressed by the International Organization for Standardization (ISO), Geneva, with the creation of the IS0 9000 series of standards. The object of IS0 is to "promote the development of standardization and related world activities with a view to facilitating international exchange of goods and services and to developing cooperation in the sphere of intellectual, scientific, technological and economic activity" (ANSI/ASQC, 1990).

In the United States, certification is achieved through an audit by a third party approved by the Registrar Accreditation Board (RAB). RAB is an affiliate of the American Society for Quality Control, and the registrar program is part of the American National Standards Institute's (ANSI) accreditation program. ANSI is the U.S. member to the ISO. A current list of third-party auditors can be obtained from

Registrar Accreditation Board
6 11 E. Wisconsin Ave.
P.O. Box 3005
Milwaukee, WI 53201-3005
(414) 272-8575
fax (414) 765-8661

The IS0 standards are not specific to any one industry or process but are broadly defined to encompass all areas. The five standards are

9000: Selection of the right standard
9001: Product development, production, delivery, and follow-up
9002: Production and delivery
9003: Final inspections and testing
9004: Guidelines

Seafood processing is covered under IS0 9002 or 9001, depending on the function of the company If carried out as planned, the standardization should help international trade. The responsibility for guaranteeing quality is shifted from the buyer to the producer. However, the certification process may be expensive and difficult to standardize (Chynoweth and Mullin 1992).

ISO registration may prove unnecessary to American seafood companies. If a company already has a comfortable trade relationship, its European buyer may be willing to continue to send over inspectors to be sure of the existence of a competent program instead of requiring ISO certification. Both the FDA and MFS inspection programs result in certificates suitable to existing EC needs. The consolidation of the EC and evolving standards may change future needs and requirements. If the standards address only microbial safety, then the U.S. HACCP as it is now constituted will meet EC requirements. If, however, the EC requirements extend to price and general quality, then U.S. HACCP programs may be inadequate to meet European standards.

EUROPEAN COMMUNITY

The new, unified European Community has shifted its inspection focus to the point of origin, a strategy which reinforces the value of programs such as ISO 9000. The regulations are published in the *Official Journal of the European Communities*, volume 34, September 24, 1991. EC Directive 91/493 sets standards for both European and foreign producers. The quality assurance requirements of the directive are listed in article 6 and incorporate HACCP principles.

The purpose of the EC is to form an economically powerful union of its 12 member countries: Belgium, Britain, Denmark, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, and Spain. From a tariff perspective, the EC is also a customs union. A common tariff is applied on imports to the EC, and all products are free of duty within the 12 member nations.

The following directives in the *Official Journal* pertain to seafood:

- 91/67, of 28 January 1991, concerning the animal health conditions governing the placing on the market of aquaculture animals and products
- 91/492, of 15 July 1991, laying down the health conditions for the production and the placing on the market of live bivalve mollusks
- 91/493, of 22 July 1991, laying down the health conditions for the production and the placing on the market of fishery products
- 91/2587, of 26 July 1991, chapter 3, amending 87/2658 on the tariff and statistical nomenclature and on the Common Customs Tariff
- 91/3865, of 16 December 1991, fixing the reference prices for fishery products for the 1992 fishing year

Directive 91/493 concerns imports of seafood into the EC, but, as EC fisheries consultant, Peter Howgate puts it, "[It's] no big deal for the

United States" in terms of microbiological safety. The directive does not require any action that exceeds HACCP requirements. The purpose of the directive is to define how fishery products will be regulated in the EC based on equivalency of quality standards and control. The directive places more emphasis on control during processing than on final inspections. Although HACCP is not specifically mentioned, the four steps on which the directive is based are consistent with HACCP concepts: identification and monitoring of critical points, keeping records, and sampling. The sample analysis must be performed by a competent authority. ("Competent authority" is a nebulous term that will be more completely defined in the upcoming annexes [Howgate 1993]).

The EC is protective in its stance towards its agricultural industry. "The U.S. proposed during the Uruguay round of the General Agreement on Tariffs and Trade (GATT) a zero-for-zero measure where the U.S. would remove all tariffs on certain goods in exchange for reciprocal action on the part of other nations. Seafood is included in this zero-for-zero proposal. This rather strong proposal has been met with resistance on the part of many GATT members, particularly the EC, and prospects for its adoption appear slim. The outcome of the Uruguay round is unclear" (AIPCEE 1992).

CODEX ALIMENTARIUS

International guidelines for seafood safety essentially lie under the auspices of the United Nations, whose Codex Alimentarius (Food Code) sets international standards for minimum safety. In practice, major importing countries have their own standards, which exceed Codex standards.

The Codex Alimentarius is a joint project of the Food and Agriculture Organization (FAO) and the World Health Organization (WHO). It is the compilation of all the standards, codes of practice, guidelines, and recommendations of various world governments by the Codex Alimentarius Commission (CAC). The CAC is a subsidiary body of the FAO and WHO and is funded by these two groups and open to all of their members.

The purpose of Codex is to facilitate the world trade in food by means of international standards incorporating the goals of fair trade and consumer protection. Codex balances the removal of trade barriers with an emphasis on the ethical aspects of food supply. The standards imposed by Codex address safety assurance and are generally exceeded by U.S. products. The Codex Commission meets every two years to consider revision of standards. Some current concerns are codes of practice for surimi, addition of sensory techniques to other evaluation practices, and questions about aquaculture. NMFS represents the U.S.; the FDA is the alternate delegate.

CONCLUSION

The goal of the NFI is to increase U.S. seafood consumption to 20 pounds per person by the year 2000. To realize even a portion of this objective, the seafood industry will need to develop seafood programs that are part of greater efforts to promote seafood consumption. It currently appears that HACCP programs will be mandated for each U.S. processing plant as well as some vessels. Although such programs are ostensibly designed for controlling microbiological contamination of seafood, their development has much broader use and implications: a program and management structure for controlling other aspects of seafood safety and quality; an important promotional device for assuring the public of seafood safety; and a way to meet evolving international standards for seafood safety and quality.

While HACCP-based seafood programs have been traditionally designed to cost effectively reduce seafood contamination, the structure of the programs may be flexible enough to accommodate future firm and industry needs. Evolving European standards may require programs that assure seafood quality and integrity beyond microbiological contamination. It is recommended that as the US. seafood industry adopts HACCP, it consider how this program will fit within a longer-term commitment to seafood quality control. The general design of HACCP may prove to be a flexible and economically effective structure for incorporating other quality control objectives and programs.

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IMPORT STANDARDS AND REGULATIONS FOR SEAFOOD SOLD IN THE EEC, AND IN-PLANT QUALITY ASSURANCE

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INTRODUCTION

The single European market came into effect January 1, 1993. In preparation for this event, a wealth of legislation over many fields of activity had to be harmonized to become EC legislation. Food laws were included in this harmonization program with the aim that member states could have confidence in the safety of foods produced anywhere within the EC. In principle, and ultimately in practice, foods produced in any member state can be traded throughout the Community without any hygiene and safety checks at borders, although there will be a brief period while member states introduce national legislation when some foods might still be subject to checks. The harmonized regulations also impose a single set of criteria for the entry of imported products, and once a food product has entered a country within the EC, it can be distributed without further checks at internal borders.

Broad classes of food commodities are the subject of separate legislation, and two directives apply to fishery products. They are the council directive of 22 July 1991, laying down the health conditions for producing and marketing fishery products (91/493/EEC), and the council directive of 15 July 1991, laying down the health conditions for producing and marketing live bivalve molluscs (91/492/EEC) (Council of the European Community 1991a & b). As only a very small amount of live bivalve molluscs enters international trade, this article will not discuss the latter directive. Community law requires that member states enact national legislation to put into effect the requirements of a council directive.

Harmonizing food laws within the Community has also formalized a shift in approaches to ensuring the safety and quality of foods. There will be less reliance on inspecting products; rather, the basic principle is that the safety of food should be assured by control and inspection primarily at the point of production. This is in accord with current thinking on quality assurance and inspection of food products. The directive also establishes in legislation the principle of "equivalency" with regard to imported fishery products-products imported into the Community must be produced under conditions equivalent to those applicable in the Community and subjected to equivalent controls. The directive, then, is worth studying by anyone interested in quality assurance and inspection of fishery products because it lays down a framework of principle and practice for regulating safety and quality of fishery products.

PROVISIONS OF THE DIRECTIVE

General

Quotations in this paper are from the English edition, but versions are available in the other official languages of the Community.

The July 22, 1991 directive consists of three parts: a preamble of 2 pages, which states the reasons for the directive and its principles; 5 pages of provisions of the directive, which define the legislation; and 13 pages of a technical annex laying down conditions for handling, processing, and storing fishery products.

Some Definitions

Article 2 of chapter I, General Provisions, defines terms used in the directive. Some, like "chilling," are general technological terms and have no special meaning in the context of the directive, but some terms are worth picking out for their importance in the application of the directive.

Fishery products--all seawater or freshwater animals or parts thereof, including their roes, excluding aquatic mammals, frogs, and aquatic animals covered by other Community acts.

Competent authority-the central authority of a member state competent to carry out veterinary checks, or any authority to which

it has delegated that competence. (Note: it is common in many European countries for meat foods and premises where meat foods are handled and stored to be controlled by persons with veterinary qualifications. Hence the reference to "veterinary" checks.)

Establishment - any premises where fishery products are prepared, processed, chilled, frozen, packaged, or stored. Auction and wholesale markets in which only display and sale by wholesale takes place are not deemed to be establishments.

Placing on the market-holding or displaying for sale, offering for sale, selling, delivering, or any other form of placing on the market in the Community, excluding retail sales and direct transfers on local markets of small quantities by fishermen to retailers or customers, which must be subject to the health check laid down by national rules for checking the retail trade.

Factory vessel-any vessel on which fishery products undergo one or more of the following operations followed by packaging: filleting, slicing, skinning, mincing, freezing, or processing. The following are not deemed to be factory vessels:

- fishing vessels in which only shrimps and molluscs are cooked on board
- fishing vessels on board which only freezing is carried out

The Competent Authority

The directive places certain responsibilities on the "competent authority" defined above. This is in effect the inspection agency in the country, but how it is organized for fishery products differs among member states. Only one country, Denmark, has a dedicated fish inspection service. In other states the requirements of the directive will be enforced by the national or local government body responsible for the safety of foods generally, or more specifically, meat foods. In the United Kingdom, food laws are enforced by environmental health officers employed by local government.

Approval of Establishments

A central requirement of the directive is that fish placed on the market must have been handled, processed, packed, and stored in approved establishments. An approved establishment must meet the technical requirements for construction, equipment, and operation specified in the annex to the directive. An approved establishment is given a registration number, and the competent authority must submit a list of approved establishments to the commission. Only products from approved and registered premises may be marketed.

The competent authority is also required to "register" auction and wholesale markets, which must comply with the appropriate standards specified in the annex to the directive.

Monitoring by the Commission

The directive allows for monitoring of application of the directive by "experts" from the commission. These experts will be employed by the commission and will have the power to make on-the-spot checks to verify that establishments are complying with the provisions of the directive. For this purpose, the commission will recruit a small force of inspectors.

APPLICATION TO EXPORTING COUNTRIES

Though the primary objective of the directive is to harmonize practices within the Community, it is a principle of the directive that its provisions should apply equally to imports from "third countries" and that there should be a common import control system applied by all member states of the Community. Article 10 of the directive is quite clear:

> Provisions applied to imports of fishery products from third countries shall be equivalent to those governing the placing on the market of Community products.

What this means is that the EC requires fishery products intended for export to the Community to be processed under conditions equivalent to those prevailing in the Community and to have been subjected to inspection and control equivalent to that applied in the Community. This principle of equivalence is being applied to imports by other countries importing fishery products, particularly by authorities in the U.S. and Canada.

Before the introduction of the single market, each member state controlled the safety of imported fishery products according to the legislation in force in that state. Fishery products imported into a country, or for that matter, produced in a country, could be further inspected when they crossed a border. Control was exercised by sampling and inspecting a sample from a consignment. The directive now establishes a completely different principle - control will be at the point of production, and

though inspectors at the ports of entry of imports still have the right to inspect consignments, such action is expected to be the exception. Clearly this approach will work only if there is effective control over the safety of products during production and effective monitoring by the competent authority.

In order to apply the principle of equivalency, the commission reserves the right to carry out inspections of the situation concerning hygiene and inspection in the exporting country by experts from the commission and the member states. Article 11, section 2 states

> In order to allow the import conditions to be fixed, and in order to verify the conditions of production, storage and dispatch of fishery products for consignment to the Community, inspections may be carried out on the spot by experts from the Commission and the member states.

The experts will be appointed by, and working for, the commission, and the commission will bear all costs of the inspection.

Though the commission reserves the right to carry out inspections in the exporting country, this does not necessarily mean it will do so. Each country will be considered of itself, and specific import conditions will be fixed, depending on what the directive refers to as the hygiene situation in that country. When fixing these import conditions, the commission will take into account the situation with regard to the existence and competence of an inspection service and the hygiene standards prevailing in the industry.

> When fixing the import conditions of fishery products referred to in paragraph 1, particular account shall be taken of:
> (a) the legislation of the third country;
> (b) the organization of the competent authority of the third country and of its inspection services, the powers of such services, and the supervision to which they are subject, as well as their facilities for effectively verifying the implementation of their legislation in force

The annual per capita consumption of fish and fish products in the Community is around 20 kg, live weight equivalents (FAO 1990), ranging from a low of 9 kg in the Netherlands to a high of 50 kg in Portugal. As about half the fish products consumed within the Community are imported, control over production in exporting countries will not be a trivial matter. Most of the fishery products, by weight, entering the Community come from countries with effective fish inspection services in place, and I do not imagine the change to the new system will present any problems in these cases. However, the Community imports fishery products from around 140 countries, and some, perhaps many, of these do not have at present fish inspection services that will meet the standards required by the commission. The directive requires that establishments desiring to export to the Community must be approved and registered by the competent authority and the competent authority must submit a list of approved establishments to the commission. Consignments not bearing an approval number, or a number not on the list submitted to the commission, will not be permitted entry into the Community. There is provision for direct approval of establishments in exporting countries by commission experts if the commission, on the basis of an inspection by its inspectors, is not satisfied with the effectiveness of the competent authority and its inspection services.

The commission's own team of inspectors is expected to be in place in mid-1993, but clearly it will be some time before it can consider or survey the situation in all countries exporting to the Community. In the meantime it is up to each member state to ensure the safety of fishery products entering that country.

PRODUCT STANDARDS

The thrust of the directive is control over the safety of fishery products by control over conditions for processing, storage, and distribution, not by control of the quality of end products. The directive, though, does have some requirements for testing products.

Freshness

Fitness for human consumption is tested by sensory evaluation for freshness There is a separate council regulation, 103/76, which requires that fish must be inspected at first sale, essentially when landed, and classified into grades of freshness and size (Howgate 1987). Three grades of freshness, E, A, and B, are defined by sensory attributes for fish considered suitable for human consumption, and fish which is not fresh enough to be classified into one of these grades is deemed unfit for consumption. The directive under discussion here refers back to this regulation and further allows for products to be checked at any point in

the processing, storage, and distribution chain for compliance with the minimum freshness standards defined in the regulation.

The sensory evaluation for freshness may be supplemented by chemical or microbiological tests Total volatile basic nitrogen and trimethylamine are included as tests for freshness, though limits have not yet been set.

Histamine

The directive specifies a sampling scheme and limits for histamine that can be applied to fish of the Scombridae or Clupeidae families. A sample of nine units are taken and analyzed individually. The following criteria are specified:

- the mean value must not exceed 100 ppm
- two samples may have a value of more than 100 ppm but less than 200 ppm
- no sample may have a value exceeding 200 ppm

Contaminants

The directive requires that "fishery products must not contain in their edible parts contaminants, such as heavy metals and organochlorines, present in the aquatic environment at such a level that the calculated dietary intake exceeds the acceptable daily or weekly intake for humans." This principle has still to be translated into concentration limits.

Microbiological Criteria

The commission may lay down microbiological criteria for products, including sampling plans and methods of analysis, where there is a need to protect public health. One set of criteria, for cooked crustaceans and molluscs, has been issued (Commission of the European Communities 1992).

THE ANNEX

The annex contains the detailed conditions and requirements for handling, processing, storing, and dispatching fishery products from landing at ports to packaging and transport.

The separate chapters and sections include the following:

Conditions applicable to factory vessels
Requirements during and after landing
General conditions for establishments on land
General conditions relating to premises and equipment
General conditions of hygiene
Premises and equipment
Staff
Special conditions for handling fishery products on shore
Conditions for fresh products
Conditions for frozen products
Conditions for thawing products
Conditions for processed products
Canning
Smoking
Salting
Cooked crustacean and molluscan shellfish products
Mechanically recovered fish flesh
Conditions concerning parasites
Health control and monitoring of production conditions
Packaging
Identification marks
Storage and transport

The various chapters are written as brief codes of practice for the operation under consideration, and any factory vessel, market, or establishment that is already operating to good manufacturing practices will meet the requirements of the annex.

IN-PLANT QUALITY ASSURANCE AND HACCP

An approved establishment must meet the requirements specified in the general provisions of the directive which, in article 6, explicitly lays a responsibility on "persons responsible for establishments" to have effective quality assurance systems in place in the plant.

Member states shall ensure that persons responsible for establishments take all necessary measures, so that, at all stages of the production of fishery products, the specifications of this directive are complied with.

To that end, the said persons responsible must carry out their own checks based on the following principles:

- identification of critical points in their establishment on the basis of the manufacturing processes used;
- establishment and implementation of methods for monitoring and checking such critical points;
- taking samples for analysis in a laboratory approved by the competent

authority for the purpose of checking cleaning and disinfection methods and for the purpose of checking compliance with the standards established by the directive;

- keeping a written record or a record registered in an indelible fashion of the preceding points with a view to submitting them to the competent authority. The results of the different checks and tests will in particular be kept for a period of at least two years.

All this reads very much like the principles of hazard analysis and critical control points (HACCP) (ICMSF 1988), but HACCP is not referred to as such in the directive.

Throughout the food industry in general in Europe, including the fish processing industry, there is an increasing use of the HACCP approach for controlling microbiological hazards of foods. Generally seafoods are not common sources of food poisoning, and where they are implicated, most outbreaks are associated with bacteria, viruses, or toxins present in the food when caught or harvested. Examples are various forms of food poisoning from bivalve shellfish throughout the world and ciguatera poisoning in some countries (Ahmed 1991; Bryan 1987; Gibson 1992). The EEC directive on marketing of live bivalves controls the intrinsic safety of bivalve mollusc, and the directive on fish products forbids the marketing of fish from specified families *(Tetraodontidae, Molidae, Diodontidae, Canthigasteridae),* which are associated with intrinsic toxins, and products containing ciguatera toxin. Food poisoning resulting from contamination of fish products during processing or from poor handling and storage practices are quite rare, the most common being scombrotoxin poisoning. Criteria for histamine content referred to earlier are intended to control this hazard.

There have been considerable changes in the marketing of fish in Britain over the last couple of decades, changes which have had a major impact on quality assurance practices in the processing industry. The number of fishmonger shops and similar specialist outlets for fish has declined over this period, and more fish is being sold through multiple retail outlets-supermarkets and similar stores. These outlets are now responsible for about two-thirds of retails sales of frozen fish and about one-third of retail sales of "wet" fish in Britain. Of the wet fish, about half are sold at fish counters and half as prepacked products. Sales of ready-to-eat fish products and of "recipe" dishes, that is, complete meals incorporating fish, are increasing markedly. Multiple retailers set high standards for both the safety and the consumer acceptability of the products they market, and as they have considerable buying power and consequently an ability to dictate conditions, they have had a significant impact on improving quality assurance practices in the fish-processing industry. In addition, trade associations, like the Sea Fish Industry Association, the Scottish Salmon Growers Association, and the Shetland Seafood Quality Company, set standards for products or guidelines for the manufacture of products marketed by their members.

There is a general worldwide shortage of fish. Natural stocks throughout the world are fully exploited, if not overexploited, and though farmed products are making an increasing contribution to supplies, they are still only a small proportion of the total. At the same time demand for seafood is increasing. Fish is recognized as being a nutritious food, and, if of good quality, very pleasant to eat. As a result of restricted supplies and increasing demand, the price of fish has increased over the years more than that of other meat foods. Some species of fish, particularly shellfish, have long been considered luxury foods, but there is a tendency now for almost all varieties of fish to be considered expensive foodstuffs. Naturally, the consumer is expecting high quality for a high-priced product.

Regulatory authorities have been tightening up their control over the safety of foods, including fish products. I think it has to be accepted that fish processing has not led the field in standards of hygiene and sanitation, but the tightened regulations of the last few years are improving the situation. Certainly the EC directive on hygiene in fish processing has markedly changed attitudes in the fish processing industry in Britain. It might not be possible to get an exact figure for Britain or the EC, but in Aberdeen alone some tens of millions of pounds has been spent on new or refurbished processing plants to meet the requirements of the directive.

These pressures, from the marketers of fish products, from consumers, and from regulatory authorities, have resulted in a marked improvement in the quality of fish available to the consumer at all types of outlets and in a marked improvement in quality assurance practices in the industry. Control over hygiene and safety is accepted as a basic and essential requirement in fish processing, but consumer

satisfaction and at least maintenance of, if not increasing, market share in a competitive environment are seen as important objectives of quality assurance. Fish processors, certainly those selling under their own brand names or supplying the multiple retailers, view the provisions of the EC directive for hygiene, sanitation, and product quality as minimum requirements and in practice will work to higher standards. For example, the minimum freshness standard required in the directive, equivalent to around 15 days in ice for typical demersal species like cod, would not be acceptable to a processor with any pretensions towards supplying good quality products. The specifications for freshness typically imposed by multiples or by secondary processors for either prepacked wet fish or frozen products are equivalent to about five days in ice. Prepacked wet fish of this quality, in air, MAP, or vacuum pack, would be date stamped with a three-day storage life from the time of packing.

HACCP methodology is adopted as part of a total quality management (TQM) system (Shaw 1992) in a company. TQM is seen as the means of achieving consumer satisfaction through consistently high quality and safety. TQM can be seen as an extended HACCP approach. The same principles of defining hazards and identifying and monitoring critical points are adopted, but a hazard is any circumstance that could affect any aspect of the quality of the product, induding safety.

Many food-processing companies in Britain, including those manufacturing fish products, use BS 5750, part 2 (British Standards Institution 1987, identical to ISO 9002-1987 and EN 29002-1987), as a model for their quality assurance systems, even if they do not seek accreditation as complying. It must be remembored that meeting the provisions of ISO 9002 is no guarantee that the product is of good quality, only that the quality assurance systems will consistently achieve the standards of quality, good or bad, set by the company.

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INTERNAL MARKETING OF QUALITY AND MARKETING ORIENTATION AT THE NATIONAL LEVEL: COOPERATION BETWEEN THE NORWEGIAN GOVERNMENT AND THE INDUSTRY

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INCREASED FOCUS ON QUALITY

During the 1980s, various internal and external factors had an important impact on the attitudes towards quality in the fishery sector in Norway.

The fishery industry entered into a period of reduced quotas and subsequently reduced supply to the fish-processing industry. At the same time, competition in the market became stronger and more difficult and thus made it clear that there had to be strategies other than increased volume through which profit could be made.

Norway's main competitors in the seafood market, like Canada and Iceland, have been improving the quality of seafood through various means, and Norway's status as the number one quality seafood producer has therefore in some markets been challenged. Although markets for less expensive products can be found, it is more and more obvious that an increasing number of companies and sectors are competing on quality and with brand products. In this situation it is important to be in the market to sell to the best paying, quality-conscious customers, who demand safe products and specified quality at the correct price.

Furthermore, the Norwegian system of subsidizing the fisheries sector has changed dramatically, from a system of a general income guarantee to a general improvement of the framework of the fisheries sector. This latter policy, it is believed, results in an industry founded on a sound economic basis, an industry that has more efficient units of production. The most important factor in the increasingly significant role of quality is the process of establishing a single market within the European Economic Community (EEC). The Norwegian industry also heeded U.S. talk about a mandatory fish inspection program on all imports.

The Single Market

Europe is Norway's most important market, importing some 60 percent of our total export of fishery products. In Europe efforts have been underway for many years to establish the EEC as one single market as of 1 January 1993. The single market will be a community wherein goods, money, and people can move freely. Existing technical obstacles to intra-Community trade will be removed and replaced by common rules affecting marketing of goods and standardization of production.

Whereas an EEC council directive (directive 91/493/EEC, of July 1991) lays down the health conditions for the production and the general admission of fish to the market, the EEC council requests the different entrepreneurs in the market to strive for higher standards and thereby increase competition and efficiency within the community. As a result of this policy, there is a growing tendency for customers to ask Norwegian exporters to produce certificates of quality assurance according to principles in the International Standard's IS0 9000 and ISO 45000 series.[1] In March 1993, the company NORFRA became the first exporter in Norway to receive the ISO 9002 certificate.

National Regulations

So that Norway's regulations will be consistent with those of the EEC, the Government has proposed an amendment to our national regulations. Because the technical and hygienic standards are very high in Norway, the new EEC regulations will have only limited

[1] International Standard ISO 9000 and ISO 45 000 have been adopted as European Standard EN 29 000 and EN 45 000 and as Norwegian Standard NS-ISO 9000 and NS-ISO 45 000.

impact as far as investments are concerned. The seafood industry in other countries, including member countries, is facing massive investments in order to comply with the new technical standards set forward by the council. The major change in Norway will be the question of a compulsory monitoring system for all establishments to ensure that the production of fishery products complies with the directive. Such a monitoring system will be based on the principles of hazard analysis and critical control points (HACCP).

FROM A NATIONAL SEAFOOD INSPECTION SYSTEM TOWARDS AN INDIVIDUAL QUALITY ASSURANCE SYSTEM

The fisheries sector has previously been the most important sector of the Norwegian economy, The industry is fragmented, with numerous fishers and a large number of small- and medium-sized fish-processing companies spread along the Norwegian coastline. Today we have a register of about 21,000 full-time and part-time fishers, about 12,000 employed in the processing industry, and 6,000-7,000 employed in the fish farming industry. Recurring problems in such a fragmented structure are to assure a consistently high quality of goods from the many suppliers and to coordinate efforts to maintain and achieve the high quality of the products.

It is well known that the existence of a large group with a common interest (high quality) does not automatically give rise to collective action. There must be an individual incentive to join in, or there must be compulsion (Olsen 1977).

National Seafood Inspection System

In Norway there has always been strong governmental involvement in the fisheries sector to secure the national economic interest. The first governmental intervention occurred in 1444, with regard to the inspection of stockfish. The first national act on "quality control of fish handling and processing" was implemented in 1937. The act has since been mended, in 1958, and reviewed, in 1986. It is still a major instrument in national efforts to secure a high standard of quality within the sector.

The law, which lies under the jurisdiction of the Directorate of Fisheries, is implemented through a system of regional fish inspectors and laboratories. The main task of the inspectors is to undertake quality inspection[2] of fish as they are landed, processed, and stored. Issuing different certificates (health, grading, and so on) on consignments of seafood ready for export to certain countries occupies a significant part of their time. It is also the duty of the fish inspectors to control the hygienic standard of all fishing vessels and processing units to monitor conformity with the specified requirements. During the 1980s the department was also involved in the national resource control.

The quality inspection of fish and other foodstuff at the point of retailing is, however, monitored by the Norwegian Food Control Authority.

Quality Inspection

The focus of the fish inspection authorities in Norway has been on quality inspection. Those who are not following the rules will get a fine, get an improvement order, or even lose their license. However, more serious fraud cases are taken to court.

Because of the way the fish inspection system has been operating, with emphases on controlling quality, issuing certificates, and monitoring resources, there has been less time left for giving advice to the industry on quality matters. Therefore, to a large extent, fish inspectors have been recognized as "quality police." At the same time there have been few incentives for the industry to produce a higher quality than that required by the regulations; as a result, the national standard has become a maximum standard.

However, through this national system for mandatory fish inspection, the government has been able to "guarantee" the quality of consignments of fishery products. Producers in other countries have thus recognized our national inspection system as a significant competitive force in the market.

Quality Assurance Systems

Through the ongoing process of establishing a general market standard in the EEC, we have faced a process in which the responsibility for monitoring and assuring a certain production standard gradually is being transferred from the governmental to the private sphere. The greater responsibility put on

[2]Testing the freshness of the fish through sensory and biochemical tests. The tests are carried out by random sampling

the processors to ensure the health and safety of the consumers implies that safeguarding quality, including monitoring internal quality, has to be an integrated part of the processing activities of any successful company.

We therefore believe that in the near future, Norway will have a system where the national fish inspection system will continue to play a vital role as a system for securing a "minimum (high) quality standard" through inspection and monitoring of processing establishments. In addition, the National Seafood Inspection System will possibly be accredited as a competent body for issuing health certificates for fishery products to be exported. It is urgent that we strengthen the advisory part of the service to facilitate improved systems for quality assurance in the industry.

Above this "minimum level," the fishers and processors who have a policy of supplying seafood to quality-conscious buyers paying the highest prices will have to introduce systems through which quality control and quality assurance can be ensured within the company. Such quality systems will most likely be based on the principles of quality assurance rather than on those of quality inspection. To some extent such systems have to be approved through ISO certificates or through certified laboratory tests by an independent third party (the global approach).

DIFFERENT LEVELS OF STANDARD

As a consequence of the new marketing trends that have been discussed, a certain minimum standard has to be adopted in the industry before a processor can obtain an official registration number and be allowed to enter the market. The next step will be that some customers will ask the industry to certify that it is able to manufacture goods according to an ISO standard for quality assurance. These certificates are issued by certain private enterprises that are accredited in one of the EEC member countries. Those who think an ISO certificate will be the ultimate solution will have to reconsider their opinion. The most quality-conscious customers, like brand owners and supermarket chains, will, however, ask for a quality certificate before any processor is invited to negotiate a contract. In addition, processors will have to demonstrate their ability to manufacture a certain product on the basis of strict guidelines and process specifications from the customer.

NATIONAL CAMPAIGN FOR IMPROVED QUALITY

The Ministry of Fisheries (MF) is fully aware of these challenging market trends among quality-conscious consumers and has taken the initiative to maintain and strengthen our position as the leading quality seafood producer. The Government designated 1990 "the Quality and Marketing Year" in the fisheries sector. To accomplish this, the Government approved and launched a national campaign for improved quality on all seafood. The campaign continued the following years but was due to be terminated by the end of 1993.

Organization

The campaign-called "Kvalitetsbølgen" (the "Wave of Quality")-_has been planned and implemented as a joint program between the MF and major fisheries and the aquaculture organizations. The Norwegian Institute for Fisheries and Aquaculture was given the secretarial functions for the coordination of the program. A professional public relation agency is assisting in the preparation and presentation of the necessary material and brochures. The different activities have been agreed upon by the Steering Committee and executed either by the Norwegian Institute of Fisheries and Aquaculture or by one of the organizations involved.

The campaign has thus become a collaboration among three main parties:

1. the Government
2. the producers and the processors
3. research and development institutions

Objective

"Quality"[3] means different things to different people. The main objective of the first phase of the campaign was to motivate and influence the fishers' and industry workers' awareness of and attitude to quality in all Norwegian seafood. An objective of the campaign was to teach people to recognize "quality" as meaning that a product has characteristics that correspond "to specifications from identified customers."

[3] **According to NS ISO 8402 the definition is "The totality of features and characteristics of a product or service that bear on its ability to satisfy stated or implied needs."**

A further objective of the campaign Was to increase the total market value of the fishery products and the profitability in the Norwegian seafood industry. Finally, for nutritional and health reasons, it was an objective to increase the domestic consumption of seafood in Norway.

Target Groups

The target groups of this campaign are the fishing industry, the fish-processing industry, and all involved in marine aquaculture. But people engaged in related activities in the fishery sector, such as research, education, and administration, also have been included.

The First Phase-Awareness and Attitude

During the first phase, the campaign focused on awareness, attitude, and knowledge. In this connection, different kinds of informational material were developed; some material was made specific to a particular group, and some was made general for the entire target population.

Seminars

Initially a press conference was held to brief invited journalists about the campaign soon to he launched. As a result, many articles focusing on quality in the fisheries were printed.

At the beginning of the campaign, another seminar was held at which various topics related to quality were discussed. A concluding seminar is planned by the end of this year to review the achievements during the campaign period.

Seminars focusing on quality and quality assurance were held in 12 of the main fishing municipalities. Much local initiative has been noticed in the wake of these seminars, and subsequently, many companies are now implementing quality assurance programs.

Brochures

The Norwegian Institute of Fisheries and Aquaculture wrote the text for each publication, which was then reformulated by the public relations agency. The text and drawings were reviewed by all members of the Steering Committee before the brochures were published. These publications highlight a number of activities:

- The importance of having support from highly motivated and dedicated managers who need to understand and participate in all quality matters. A pamphlet was distributed to about 8,000 managers, skippers, boat owners, and fish farmers.
- The importance of informing everybody involved in fish production and processing about the need for improved quality and to discuss quality not only as "freshness" but also in terms of "just in time" and "according to specifications." A brochure on this topic was distributed to 45,000 persons.
- The importance of identifying improvement areas and to learn what people in the sector understand by quality. The Norwegian Institute of Fisheries and Aquaculture (Olsen 1991) conducted a survey, asking fishers and those who work in the processing industry their opinion of the present quality standards in the handling and processing operations. Everybody seems to be aware of major shortcomings in relation to quality, but nobody is willing or able to take the responsibility for the situation. These are the main conclusions we were able to draw:
  - Support from top management is necessary.
  - Quality can be improved at many stages of the processing line.
  - The supplier and the customer, external and internal, should establish a good relationship to achieve a higher quality end product.

  We determined which activities to highlight in the second brochure by asking the people involved rather than referring to the common literature on quality assurance systems.
  - The importance of identifying the needs of our main customers. How do consumers in our major markets recognize the quality of Norwegian seafood, and how does this information correspond with our own opinion?

On the basis of a survey conducted by the Norwegian Institute of Fisheries and Aquaculture in the U.S. (Olsen 1991), along with conclusions from various marketing reports, a third brochure was distributed. These are the main conclusion that could be drawn:

- Norwegian exporters are considered to be reliable and professional.
- Norwegian brands are hardly recognized at all.
- The quality of Norway's salmon is considered to be on top, whereas the quality of its cod is considered to be inferior to products from Iceland and Canada.

Advertisements

During the campaign we took out nine different advertisements in main fisheries newspapers and magazines. Our intention was to give facts and announcements of important messages in the brochures.

Newsletters

We printed monthly newsletters in the two main fisheries newspapers, intending to give information about people who had responded to the campaign and had started implementing different "quality projects." The newsletters were also open to questions from the readers. However, we stopped the activity after one year, as it was rather demanding to follow up given the resources available and given the fact that the industry did not inform us about ongoing activities.

Also we printed a series of six posters and distributed them to the processing industry.

Scholarship for Journalists

As a follow up to the newsletters, we introduced five traveling scholarships for journalists. By giving these fellowships, we managed to get a lot of articles on quality printed in fishing newspapers and locally based newspapers. Various articles covered the Norwegian position in the Spanish market for salted fish as well as the position in the German wet fish market. Other articles are still to be printed. We believe this has been a worthwhile strategy to get journalists aware of the quality issue.

The Second Phase-Learning by Doing

In the second phase of the campaign, the strategy was to continue the efforts for changing attitudes and to support various ongoing activities and initiatives in the industry.

Quality Assurance Program

One major project has been a training program within the Directorate of Fisheries to educate the fish inspectors in the principles and the implementation of quality assurance systems. In this regard, five different pilot projects have been implemented in cooperation with different fish-processing plants, one for each control district covered by the Directorate of Fisheries. These projects are carried out in cooperation with different institutes as professional resources. Special emphasis was put on the question of implementing and monitoring the HACCP system since it will be compulsory as a minimum monitoring system for the industry.

Guidelines for Implementing HACCP

The Directorate of Fisheries, in cooperation with the Norwegian Institute of Fisheries and Aquaculture and producers associations, has been carrying out a project to establish general guidelines for implementing the HACCP system in different companies like the prawn factories, the filleting industry, and the processing industry in the aquaculture sector. The progress of this project has not been satisfactory because the Directorate has not given necessary priority to the project.

Guidelines for Handling of Fresh Fish

Another activity carried out by the Norwegian Institute of Fisheries and Aquaculture is the preparation of guidelines and instructions on handling and grading fresh fish (groundfish), The guidelines are not revolutionary, but rather a comprehensive and systematic presentation of the somewhat boring rules and regulations given in "the blue book."

Other Activities

Because information and motivation are considered important parts of the campaign, different projects within these areas have been supported. In this regard, activities carried out by the fish industry associations have been given some financial support. The secretariat has also been giving advice to the industry on implementing quality systems.

The Role of the Norwegian Institute of Fisheries and Aquaculture

The Norwegian Institute of Fisheries and Aquaculture was designated in 1973 as an independent research institute under the Norwegian Fisheries Research Council and was reorganized in 1992. The institute has the following obligations:

- to promote and carry out research and development work for the fisheries and aquaculture sector and thus contribute to a better utilization and management of the biological resources of the sea
- to promote fisheries and aquaculture by information
- to give advice to the Norwegian authorities and to the fisheries and aquaculture sector

The Norwegian Institute of Fisheries and Aquaculture was designated to be the secretariat of this campaign because our institute already had taken several initiatives to get more emphasis on quality aspects. We had responsibility for writing all background information for the brochures. Two of the brochures were based on results from ongoing research projects in the Center of Economics and Marketing. We have also been responsible for carrying out the different activities under the program.

In addition, the institute has played a major role in designing and implementing quality assurance programs in the industry, and we have tested different approaches. There has been a special need for extrapolating the requirements in the ISO standard to practical procedures in the industry. The nature of this work has been partly research and partly basic consulting. With regard to consulting, our work has been taken further than our policy intends, but it was necessary at an early stage before the traditional consultants had obtained the necessary training and experience. In the next stage, we will undertake training, monitor the program, and assist in the certification of new companies. We shall not be practically involved in any enterprise.

The Norwegian Institute of Fisheries and Aquaculture has been highly involved in the planning and execution of an education program under the University of Tromsoe. The Fisheries Research Council has stressed quality in its research program, and the Norwegian Institute of Fisheries and Aquaculture has carried out research on subjects like methods for sorting fish alive, processing of prerigor fish, methods for measuring the fat content in farmed salmon, and important quality attributes for the processing of salted fish.

We have also been involved in different committees to formulate strategies for different development programs (financed 50-50) and establish priorities among applications from the industry.

INDUSTRY INITIATIVES ON QUALITY ASSURANCE

During the campaign, quality has been put on the agenda in fisheries as never before, and there has been an increased focus on the need for quality assurance and quality improvements. Several projects are being implemented, with the associations in a key role. These efforts have also identified the need for better education and training of the employees.

Quality Prizes

The Norwegian Fishermen's Association and the Directorate of Fisheries have introduced quality prizes for the fishing fleet and the processing industry, respectively. Though these prizes are not based on the principles of the more famous prizes, like the Deminger prize or the Malcolm Baldrige Award, they constitute important rewards for those who have shown an above-average interest in quality.

Quality Assurance Systems

At the beginning of this campaign, the Norwegian Institute of Fisheries and Aquaculture, in cooperation with some consultants, planned a program for implementing a quality management system in 10 companies in northern Norway. The Federation of Norwegian Fishing Industry has responsibility for implementing and coordinating the program, whereas the Norwegian Institute of Fisheries and Aquaculture has been giving professional support. This program will terminate in July; by that time most of the companies will be at the level of NS ISO 9002. The program is considered to be very successful, and another group of 26 companies have already joined a two-year program at a total cost of about U.S. $7 million. Another important quality program has been implemented in the Lofoten and Vesteraalen area. The Norwegian Institute of Fisheries and Aquaculture, in cooperation with trained teachers, has been responsible for the professional support.

This program was implemented in two separate phases. The first phase covered all 26 companies, with emphasis on motivation and education of shop floor people in order to organize and generate improvement activities. In the second phase, 19 of the factories continued and worked out system documentation.

A third program in which the Norwegian Institute of Fisheries and Aquaculture has been involved is a quality program for five

shrimp factories. The shrimp processing industry in Norway has a high level of quality and is familiar with strict requirements from customers like Marks & Spencer and the legal authorities. Therefore, there is a market-driven "quality culture" in the shrimp industry and consequently less need for motivation than in the fish-processing industry.

The marine aquaculture sector had been focusing on quality long before the campaign was launched and had, at the time we started, already made a plan--"Quality Fish Project" ("Prosjekt God Fisk")" - for implementing quality assurance in the whole sector.

Through this program, they have worked systematically towards awareness of quality and practical information on the handling and processing of farmed salmon to maintain the highest degree of freshness and quality. They planned a second phase to prepare the companies for the process of being certified according to international standards of quality. For two to three years it was expected that most companies in the aquaculture sector should introduce quality management. However, the bankruptcy of the Norwegian Fish Farmers' Sales Organization was a setback to this plan. (Unlike the fishing industry, the aquaculture sector planned to implement a strict quality assurance program giving priority not so much to education and training, but to establishing a quality system documentation).

Education

Fish processing remains a relatively labor intensive industry. One of the keys to improving performances in this industry is to find ways of helping employees do a better job. As we have implemented quality systems, we have identified the need for improved education and training of managers and employees.

This need for education cannot possibly be met by the sector alone, and so some financial and professional support is given by the Government. The training and education of workers is basically given as (1) training program[4] for specialized workers or (2) "internal training," thus using both public and private funds for education. The Directorate of Labor has made funds[5] available for companies that want to offer the employees internal training programs as an alternative to unemployment and expenditures on unemployment pensions. As a fund of this nature has been made available, a more comprehensive effort for implementing "quality" in the fish-processing industry in Norway could be made possible.

Several projects of this nature are being implemented, something that seems propitious for the future of the fisheries sector in Norway. A weak point, however, is that the fishing industry is not given the same training opportunities as the processing industry. Because the fishing industry is an important part of an interdependent production chain, its training needs should be given a higher priority.

At university level, a training program in quality management has been introduced. In connection with "the Lofoten and Vesteraalen program," the Finnmark Regional College has started an integrated one-year program on "education and development" of teachers and of key personnel in the factories.

Research and Development

The research institutes and the universities have also focused on quality, which has been given priority through special research programs administered under the Fisheries Research Council. Quality (in the handling of marine resources) has also been emphasized in development programs in connection with the annual agreement between the MF and the Norwegian Fishermen's Association.

Grading System for Codfish

Another important decision related to improving quality in the fisheries sector in Norway was the introduction of new principles for determining the minimum prices of raw fish by the Norwegian Fishermen's Sales Organization in May 1989.

Prices were previously determined on the basis of the various product categories; the new system determines prices on the basis of specific criteria of quality. The new system grades the fish into Extra, A (ordinary), and Rejection. Grade A[6] is based on the standard described in

[4]The training program for the processing industry and the marine aquaculture industry was approved in 1989; a similar program for the fishing fleet is still to be approved by the Government.

[5]The Government covers 50 percent of the labor cost if people are given internal training programs as an alternative to unemployment.

[6] In the case of nonconformity with the standard, the price can be reduced up to 30% on the basic price for the A grade.

the guidelines of the quality regulation, whereas Extra requires careful and professional handling similar to that for the grade Superior salmon. The price of grade E is about 10 percent above grade A.

The effect of this change in price regime is evident. During the first two years of the new system, the quality of the landed fish increased significantly and the rejection rate due to poor quality of raw fish was reduced. However, when practicing the new system, it has been difficult to distinguish between matters such as the objective quality of the fish and the question of fixing a reasonable price for the fish.

CONCLUDING REMARKS

The underlying message of this campaign has been that people are the most important factor when we want to achieve higher quality. Internal marketing has thus become the key strategy of this campaign. In this context we have emphasized identifying internal customers through the processing line of any company. Do the products we supply to the next customer comply with expectations or specifications? Have the employees received the necessary training and qualifications for the job they are going to perform? And finally, who is responsible for the quality level in an establishment?

The final goal should not be to establish a system only to ensure quality assurance, but also to encourage quality improvement activities in line with the Total Quality Management concept.

Today, we feel that the wave of quality that was introduced by the Ministry of Fisheries and the organizations of the sector was launched at the right moment, as the campaign for improved quality supports ongoing and planned efforts. We certainly believe that such a massive quality effort in the coming years will increase the total value of Norwegian fish resources.

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National and International Perspectives on Seafood Quality

EVOLVING INTERNATIONAL INSPECTION STANDARDS AND IMPACTS ON U.S. SEAFOOD TRADE

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INTRODUCTION

Evolving international standards will likely have an impact on seafood trade for the United States in both exports and imports. The U.S. was the number one exporting nation in the world in 1990, with over $3 billion in seafood exports, and the number two importing nation in the world, with over $5.5 billion in seafood imports (Fisheries of the United States 1991).

The international requirements will evolve from activities that are in progress in the Codex Alimentarius, negotiations under the U.S./Canada Free Trade Agreement, the North American Free Trade Agreement, and negotiations with the European Community (EC).

It is in the best interests of the United States to continue to actively participate in these activities.

CODEX ALIMENTARIUS

The Codex Alimentarius Commission is a subsidiary body of the Food and Agriculture Organization of the United Nations (FAO) and the World Health Organization (WHO). The Latin words *codex alimentarius* mean "food code." In the present context it is the compilation of all the standards, codes of practice, guidelines, and recommendations of the Codex Alimentarius Commission.

The Codex Alimentarius Commission was established in 1962. The Codex system was set up because of a widely perceived need to facilitate world trade in foods, and internationally accepted standards were seen as the means. At the same time it was realized that if such internationally acceptable standards could be developed, then these standards must be based on added protection for consumers' health. Such standards would also promote fair practices in the food trade. The objectives of freer trade and better consumer protection are mutually dependent and mutually supportive.

Membership in the Codex Alimentarius Commission is open to all member nations and associate members of FAO and WHO; some 137 countries were codex members by the end of 1989.

Codex work is divided between committees dealing with "vertical" measures and those with "horizontal" measures, that is, committees on commodities and those dealing with general subjects such as food labeling. Each standard is considered in both kinds of committee as necessary.

A Codex standard sets out the required qualities of the food commodity, as sold, in objective terms. The elaboration of Codex standards follows eight different steps to completion, Degrees of acceptance by member countries are "full acceptance," "target acceptance," and "acceptance with specified deviations."

Codex also develops recommended international codes of hygienic practice for various commodities. Their purpose is to provide guidance for good manufacturing practices, and they are advisory in nature. The Codex contact point in the United States is the Executive Officer for Codex, Food Safety and Inspection Service, U.S. Department of Agriculture, Washington, D.C.

The Codex Committee on Fish and Fishery Products is responsible for the elaboration of worldwide standards for fishery products. The United States delegate is from the National Marine Fisheries Service (NMFS). The delegation consists of technical advisors from government - that is, NMFS and the Food and Drug Administration (FDA) - and industry.

The host government for this committee is Norway. The committee, which had its first session in 1966, now meets every two years.

There are currently 15 Codex standards that are approved or in draft form for frozen, canned, dried, and salted fishery products. All standards are in the process of being revised. The purpose of the revision process is to identify baseline acceptability criteria, which, if not met, would result in governments' taking action against the product.

The aesthetic characteristics would be retained and placed in appropriate documents as advisories to be used by buyers and sellers in establishing trading specifications.

There are currently 17 recommended international codes of practice for fish and fishery products either approved or under elaboration. The committee has been requested to consider a review of the codes of practice for possible

revision and to consider incorporating hazard analysis and critical control points (HACCP) principles into the documents.

The National Standards and Specifications Branch, Technical Services Unit, Inspection Services Division, NMFS, is responsible for coordinating all work to be done to establish U.S. positions that are presented to the committee at each session. This work includes developing protocols, field testing data collection sheets, analyzing data, and soliciting comments on appropriate documents for consideration by the U.S. delegation.

It is extremely important that government and industry work in harmony to provide accurate and precise information to the U.S. delegation in order to protect the U.S. interests for trading fishery products.

CANADA - U.S. FREE TRADE AGREEMENT

A Bilateral Technical Working Group on Fish and Fishery Product Inspection was organized and the first meeting held in January 1990 in Ottawa, Canada. The objective of the working group is to harmonize inspection systems by eliminating technical trade barriers between both countries. Meetings take place approximately every six months and alternate between the United States and Canada.

The Technical Working Group consists of a U.S. cochair from the FDA, a cochair from the NMFS for trade matters and those matters where NMFS assumes responsibility, and technical representatives from the FDA, NMFS and the U.S. Fish and Wildlife Service (USFWS). The Canadian representatives include a cochair from the Department of Fisheries and Oceans (DFO), Inspection and Enforcement Directorate; and technical representatives from the Directorate, International Directorate, and from the National Health and Welfare, Canada Health Protection Branch.

There are eight subworking groups under the direction of the Technical Working Group to deal with specific areas and issues:

1. Comparison of Regulatory Measures
2. Training and Education
3. Notification and Information Sharing
4. Essential Composition and Quality
5. Facilities/Imports and Exports Inspection
6. Molluscan Shellfish
7. Aquaculture
8. Reciprocal/International Activities

Each subworking group is under the direction of a U.S. and Canadian cochair.

The major activity in harmonizing inspection systems is taking place in sensory evaluation, analytical procedures and requirements, and evaluation of the equivalency of inspection systems.

Recent sensory harmonization workshops were conducted using the latest criteria from internationally recognized sensory scientists. Expert analysts from the FDA, NMFS, and the DFO Inspection Directorate participated. An in-depth analysis of the workshops clearly indicated that use of the appropriate sensory analysis applications resulted in expert assessor harmonization. These workshops will lead to diminished technical trade barriers and enhance the trading of fish and fishery products.

Analytical procedures and requirements for microorganisms, biotoxins, and food additives are being evaluated by both countries to harmonize procedures, requirements, and action levels. Of particular interest are *Listeria* in cooked, ready-to-eat fishery products, domoic acid levels, paralytic shellfish poisoning, methyl mercury, and polyphosphates. A protocol for a collaborative study on the use of cadaverine and putrescine as spoilage indicators has been submitted to the Association of Official Analytical Chemists for approval. The study will include collaborators from the FDA, NMFS, and the DFO.

In regard to the examination for equivalency of existing inspection systems in the United States and Canada, NMFS has submit ted its voluntary HACCP-based inspection program to Canada for review. This program was developed using the Canadian Quality Management Program (QMP) as a model. The program was published in the *Federal Register* of July 29,1992 for use. It is expected that a delegation from Canada will perform an on-site visit to the United States to evaluate the program for equivalency in the near future. The United States has visited Canada to observe and review the Quality Management Program.

Other activities include arrangements for joint training, the development of a cooperative study on fish parasites by both governments and industry, and close coordination of all the activities in Codex Alimentarius.

NORTH AMERICAN FREE TRADE AGREEMENT

There is currently little activity concerning progress under the North American Free Trade Agreement (NAFTA) as it relates to fish and fishery products. Based on the most recent

meetings, it appears that evolving international standards will be used as a basis for trade. There is a committee on sanitary and phytosanitary measures that directs its attention to those areas that protect human, animal, and plant life or health. There are no subcommittees or working groups. Joint Canadian-U.S. working groups continue to coordinate with the NAFTA Sanitary/Phytosanitary Committee.

There is also a committee on standards-related measures to consider quality, nomenclature, packaging, and labeling issues.

EUROPEAN COMMUNITY (EC)

NMFS is aware that the EC directives regarding the inspection and certification requirements to be implemented July 1,1993 are a matter of concern to exporters of fishery products.

Our meetings with industry across the country during the past several months attempted to provide the industry with as much advance notice of the EC's intentions as possible so that plans could be made to meet these new requirements. It is important to note that the EC has adopted import requirements. Once the requirements are fully implemented, all countries must comply with them if their products are to be accepted into the EC.

Officials from NMFS, the FDA, and the USFWS have met with representatives of the EC to discuss the impending directives, explain the various controls and programs in the U.S., and seek clarification on a number of items described in the respective directives. These and other efforts have been undertaken to assure that there will be minimal disruption to U.S. export trade in seafood with the EC.

As an official U.S. Government agency responsible for inspecting and certifying fishery products, NMFS cannot ignore the EC import requirements. It must assure that products it certifies for export to the EC comply with appropriate requirements. In the event that a requirement is not being uniformly applied, to the detriment of the U.S., it will be viewed as a nontariff trade barrier and the U.S. Government will take appropriate trade actions.

Three EC directives have a major impact on fishery products:

1. Council directive 91/493, "laying down the health conditions for the production and the placing on the market of fishery products."
2. Council directive 91/492, "laying down the health conditions for the production and the placing on the market of live bivalve molluscs."
3. Council directive 91/67, "concerning the animal health conditions governing the placing on the market of aquaculture animals and products."

Council directive 91/493 requires that third countries (for example, the United States) have a system at least equivalent to the system described in the directive. The general provisions of the system are delineated under Article 6 with additional requirements that would be applicable in the annex of the directive in chapters 2-7, which covers sanitation of the facility, handling and storage practices, and product requirements.

Article 6 outlines the principles of the HACCP-based system. The value of such a system has been widely acknowledged by food control authorities internationally (for example., Codex Alimentarius) as well as in the United States (for example, various reports issued by the National Academy of Sciences regarding meat, poultry, and seafood products). The United States, in particular, has recognized the advantages of adopting a HACCP based inspection system.

EC representatives have acknowledged that traditional NMFS in-plant inspection techniques (such as continuous inspection) would also be considered equivalent to the HACCP-based inspection system. They have acknowledged that a lot inspection without knowledge of the handling and processing conditions would not be considered adequate.

The forthcoming system under the EC directives contains significant changes from previous experiences:

1. The establishment must be approved by a competent authority of the third country for compliance with requirements equivalent to those laid down in directive 91/493.
2. The establishment must be on a list of officially approved establishments that is submitted to the EC by the competent authority.
3. The product must bear a mark containing the approval number of the establishment.
4. The shipment must be accompanied by a health certificate.

The United States has identified NMFS the FDA, and the FWS as competent authorities for the inspection and certification of fishery products and has submitted all the required

material pertaining to laws, regulations, procedures, and so on, to the EC for evaluation. The United States has been informed that the EC will perform on-site visits between July 15 and October 1993.

Commission decision 93/185/EEC, "laying down certain transitional measures concerning the certification of fishery products from third countries in order to facilitate the switchover to the arrangements laid down in council directive 91/493/EEC," is to be implemented July 1, 1993. We have been informed that these transitional measures for certification have been taken to provide the EC with sufficient time to conduct site evaluations of the inspection systems of third countries exporting products to the EC. The decision will apply from July 1, 1993 to December 31,1994. NMFS is in the process of translating the model certificate into the nine official languages of the EC. All certificates will be bilingual.

Council directive 91/492, requirements for live bivalve molluscs, is being discussed by the FDA and the EC.

The major difference between the U.S. and the EC systems is the method of control. The EC relies on testing of the meats whereas the U.S. FDA system relies on testing the waters in the growing areas for control purposes. The United States continues to pursue EC approval for equivalency of our system.

Council directive 91/67, deals with aquaculture animals and products. The USFWS is discussing its programs with the EC to determine equivalency. The measures in this directive address matters pertaining to health and disease control.

The United States will continue to pursue clarification of language and areas in all of the EC directive that are unclear or left to interpretation. The industry will be kept informed of the status of the ongoing negotiations.

OTHER ISSUES

NMFS has received inquiries from several countries - Canada, Iceland, Chile, Indonesia and Ecuador - expressing interest in the development of memorandums of understanding to recognize each others' inspection systems for equivalency.

Initial meetings to discuss protocol for the development of a memorandum of understanding have taken place with officials from Iceland.

Any development of a memorandum of understanding will be discussed and coordinated with the FDA for mutual agreement before approval.

INTERNATIONAL TRAINING BY NMFS

The FAO, Rome, Italy, has requested that NMFS provide training assistance at workshops and seminars conducted in South and Central America over the past 18 months. The requests have originated from the Food and Agriculture Organization of the United Nations, Rome. The training has focused on quality assurance and HACCP inspection systems. All of these seminars and workshops have been conducted in Spanish, and U.S. participation has been from the National Training Branch of NMFS. The host countries have been Chile, Panama, Costa Rica, El Salvador, Honduras, Brazil, and Guatemala.

There were 790 participants in the various workshops and seminars, from 40 different countries.

NEW NMFS HACCP-BASED INSPECTION SERVICE

On July 29,1992, NMFS published in the *Federal Register* the new NMFS inspection service based on HACCP principles. This inspection service is in addition to the existing traditional NMFS inspection services available to industry. As is the case with the traditional inspection services, participation is voluntary, on a fee-for-service basis, the scope being safety, wholesomeness, and economic integrity. The service is available to all interested parties.

As of May 14,1992, three firms at four locations have been participating in the NMFS HACCP-based inspection program. NMFS has received twelve HACCP plans for review. There continues to be interest from the retail sector.

NMFS provides HACCP certification by administering a test. Interested parties can arrange for a test to be given at a NMFS facility, following an NMFS training workshop, or following an industry training workshop. This certification is recognized by the FDA.

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THE CANADIAN QUALITY MANAGEMENT PROGRAM

Ian Devlin
Department of Fisheries and Oceans, British Columbia

INTRODUCTION

During the past five years, the Department of Fisheries and Oceans and the Canadian fish-processing industry have worked together to develop the Quality Management Program (QMP). On February 1,1992 it became mandatory and is now a condition of federal registration for fish-processing plants.

In this paper I explain the rationale for developing the QMP by providing you with some background information on the Canadian fish inspection program and identifying the challenges that we were facing in delivering our inspection program and that prompted the re-examination of the way industry was being regulated. I then briefly explain the basic principles of our new QMP and clarify the Government's and industry's roles under the QMP.

THE CANADIAN FISH INSPECTION PROGRAM

The Inspection Services Directorate Mandate

The Inspection Services Branch of the Department of Fisheries and Oceans is mandated through federal legislation to inspect all fish and fish products intended for export from Canada or for interprovincial trade, and all fish and fish products imported into Canada. Through this mandate, we assure that both domestic production and imported products meet Canadian and foreign standards for grade, handling, identity, process, quality, and safety. In simpler terms, the Canadian Fish Inspection Program ensures that fish products produced in Canada or imported and sold in Canada are safe and wholesome and are fairly traded.

For fish and fish products produced in Canada, we have a dual concern: the health and safety of Canadian consumers and the overall quality of Canadian fish and fish products and their acceptability in international markets. Eighty-four percent of the fish caught and processed in Canada is exported. The Inspection Services Branch plays an important role in facilitating the trade of these Canadian fishery products through its product inspection and certification programs.

To achieve its mandate, the Inspection Services Branch has developed over the years a multifaceted national fish inspection program that focuses on the strategic steps of the fish-processing industry to ensure safe and acceptable fish products. This program involves a variety of inspection activities that include the inspection of

- domestically produced fish products to determine the acceptability of these products for sale in Canada or on foreign markets
- domestic fish-processing establishments to determine the degree of compliance with regulatory requirements for construction, equipment, and operation
- domestic fishing vessels, unloading sites, and transport vehicles to determine compliance with the applicable construction and operating requirements
- imported product and the offshore processing operations to determine the acceptability of these products for sale in Canada and the monitoring of shellfish-growing waters through the Canadian Shellfish Sanitation Program.

Traditionally, many of the decisions made under the Fish Inspection Program relied on final product analysis and the results of single independent inspections of fish-processing plants. Implementing the QMP will expand the sources of information used in making decisions. A new decision-making process based on interrelated inspection data, gathered over time by both government inspectors and the processor, will be established.

Future Challenges

Before I focus on the specifics of our new approach, I would like to comment briefly on the changing nature of the commercial environment of the 1990s, which is making innovative approaches to food inspection so necessary.

One of the key challenges will be to endure the scrutiny of the informed consumer and

public media. Because of the increase in contaminants, pollution, and threats to the environment, there has been an increase in media and public concern regarding the safety of the food supply in general and fish products in particular. International trends lead us to believe that there will be no letup in media attention in the next decade. Today's consumers are better educated, better informed, and concerned about the safety of the food they eat. In all probability the workload of all food inspection agencies will continue to

The rapid pace of changing technologies presents an additional challenge to industry and food inspection agencies. As the Canadian fish-processing industry develops new products and processes, the Fish Inspection Program must adapt its inspection methods to continue to meet its mandate.

Another major challenge for the 1990s will be responding to trade issues. The movement towards HACCP in the United States and the developments in the European Community are already indicating additional demands on the Canadian fish processors and the Fish Inspection Program. These countries and others are requiring more assurances from the Canadian Government that standards are being met.

The factors I have mentioned are all external factors that will affect both the Inspection Services Branch and the Canadian fish-processing industry; but there is another key factor internal to government that will have an impact on all of the Canadian food inspection agencies. That is the question of resources.

The Canadian Government, as well as other western governments, is under constant pressure to limit spending and inspection programs such as the Department of Fisheries and Oceans and the Department of Agriculture. Canada cannot expect to have ever increasing resources to meet the challenges of the future. We must find smarter and more cost-effective ways to carry out our mandate.

The challenges of the 1990s make it necessary for government and the food processing industries to find, develop, and implement innovative and cost-effective approaches to food inspection. These new approaches must be flexible and sensitive to the needs of the industry and permit industry to adapt and remain competitive in the changing markets.

The Department of Fisheries and Oceans' QMP is a key component of our strategy for responding to the demands of P fut;ure marketplace and addressing both industry concerns. The QMP has been developed jointly by the Canadian fish-processing industry and the Department of Fisheries and Oceans. The QMP that the Canadian fish-processing industry will be required to establish in their plants is based on the HACCP philosophy. The QMP is, like HACCP, a system designed to prevent instances of public health significance. However, the QMP has been designed to also prevent instances of unacceptable quality and economic fraud.

The development of an individual QMP for a fish-processing operation incorporates all of the basic steps involved in developing a HACCP system for a specific food product. A hazard assessment of the process operation is performed. Critical control points are identified. Defect definitions and tolerances, monitoring procedures, record-keeping criteria, corrective action systems, and company verification measures are established for each critical control point.

The QMP is not however purely a HACCP system. It could be better described as a regulatory compliance program as it is closely linked to the Canadian Fish Inspection Re gu - lations. During the initial stages of the development of the QMP, the industry-government working group decided that the QMP would be based on existing regulations, which are designed to ensure that fish and fish products are safe, wholesome, of acceptable quality, and fairly traded.

The QMP is designed for the fish-processing industry to control their processing operations within the compliance boundaries of the regulations governing the production of fish products. By implementing the QMP, the fish-processing industry will be able to demonstrate that it is operating on a day-to-day basis with controls that ensure compliance with the regulations.

Let's look a little closer at our QMP and how it fits into increasing industry's responsibility and accountability.

As of February 1, 1992, each fish-processing plant is required to have in place and be operating under a QMP specific to its fish-processing operations. The department has developed the QMP Submission Guide sist the industry in developing their programs. The guide helps the processor identify the critical control points in the process and the associated hazards and sets out for the fish-processing industry the minimum requirements for a plant's QQMP.

The QMP of a fish-processing plant will be required to address each of the 12 critical con-

trol points that are applicable to their operation. Potential hazards should be prevented through the monitoring of these 12 points:

1. incoming fish
2. other ingredients
3. packaging material
4. labeling
5. chemicals (cleaning agents, sanitizers, lubricants, and pesticides)
6. construction and equipment
7. operation and sanitation
8. process control
9. storage
10. final product
11. recall procedures
12. employee qualifications

"Critical control point" is defined as a point in time or a physical location in the process at which failure of preventative measures will expose the customer to unacceptable risks related to tainted, decomposed, or unwholesome fish or to economic fraud.

At each critical control point the fish plant must

- identify the standard that is being applied to ensure compliance with regulatory requirements
- identify the monitoring procedures and inspection frequencies that will be followed to ensure that the standard is being met during production
- identify the reporting mechanism that will be used at each critical control point to document the results of the inspections. The fish plant will be required to develop contingency plans or corrective action plans that will be followed if and when the monitoring procedures identify an instance where the standard is not being met.

The fish-processing plant will be required to have available for inspection their documented QMP that provides a written description of the program being implemented in the processing plant. The fish-processing plant will also be required to retain records of all inspections performed as part of their QMP for three years. These records must be made available when requested to inspectors from the Department of Fisheries and Oceans.

In summary, a fish-processing plant's responsibilities under QMP will be

- to develop its own in-plant QMP specific to its operation
- to implement the in-plant QMP
- to maintain the QMP records of the QMP inspections
- to correct all problems identified during the QMP inspections.

QMP INSPECTION

The Department of Fisheries and Oceans will inspect the fish-processing plant against the QMP requirements.

Individual inspectors will perform QMP inspections that will entail the following:

- verification of the written QMP to ensure that the documented standards, monitoring procedures, record-keeping systems, and guidelines for corrective action meet the minimum requirements as set by the Department of Fisheries and Oceans
- confirmation that the written QMP is being followed in the plant. This will require the inspector to observe the processor's QMP activities at each critical control point in the plant
- verification that the processor's records are accurate. This will require the inspector to withdraw and inspect parallel samples of the processor's products and compare the results with those of the company.

The completion of the QMP inspection will result in the process operation's being rated "excellent," "good," "satisfactory," or "fail." These QMP ratings represent the degree of confidence the Department of Fisheries and Oceans has in the company's ability to operate within compliance of the regulations and will determine the inspection coverage to be directed at the operation in subsequent weeks.

Fail-rated plants will be asked to voluntarily correct the deficiencies and improve their rating to at least a "satisfactory." Refusal to deal with the problems voluntarily will jeopardize the federal certificate of registration and therefore the ability of the processing plant to export its products. Plants which receive a "satisfactory" rating will be inspected on a frequent basis until they gain greater control over their process and obtain a higher rating.

Processing operations that are successful in meeting all but a few of the QMP requirements will receive an "excellent" or "good" rating. These plants will be qualified to apply for the use of the "CANADA INSPECTED" logo on their product labels. Also the product certification process will be streamlined and provided

without delay, and the company will have more autonomy in its day-to-day processing operation.

The QMP will provide added assurances that problems are identified early in the process before value is added to the product and before the product reaches the market. The QMP will also allow the department to measure the level of compliance of the industry in a uniform manner and direct its resources to those areas where problems have been identified.

The Quality Management Program-Industry's Role

The major change for industry under the QMP is that it must accept more responsibility and accountability in monitoring its performance. The processing plants will be required to perform inspections of the plant and products and initiate corrective actions when they identify a problem. And records of all these QMP activities must be maintained so that they are able to demonstrate that they consistently operate in compliance with the regulations.

The Role of Government in Regulating Under QMP

The implementation of the QMP will mean a change in the relationship between the fish-processing industry and the department. Under the QMP, the Department of Fisheries and Oceans' role will shift from solely an inspection function to include an auditing function.

The inspector will continue to perform random inspections of the process operation and products, but the focus will not be on individual lots of product or on a day of plant operation, as now is the case, but rather on the overall QMP system. The inspector's decisions will be based upon a compilation of interrelated inspection results gathered over time by both the inspector and the processor.

CONCLUSION

We feel the QMP will provide the Canadian fish-processing industry and the Department of Fisheries and Oceans with an effective mechanism to ensure the protection and assurance needed in today's demanding markets. The price of this assurance is change.

We will have to change. Industry will have to change. But this approach should realize more impact from each inspection. The number of inspections we do may be somewhat reduced for some plants, but each inspection will count for more. We will be able to focus our effort on areas of higher risk and apply our resources in a more cost-effective manner.

In summary, the Department of Fisheries and Oceans' new approach to quality management is a joint industry-government system that is aimed at preventing problems before they occur. Working together through the QMP, the Canadian fish-processing industry and the Federal Government will be able to provide Canadian and international customers even better assurance than in the past so that the high standards Canadian fish products have been known for will be met in the future.

FOOD AND DRUG ADMINISTRATION INSPECTION PROGRAMS FOR SEAFOOD

Roger Lowell
U.S. Food and Drug Administration

Sometimes the impression from the media is that the Food and Drug Administration (FDA) doesn't have a mandatory seafood inspection program in this country or that we have no seafood inspection program at all. I take issue with this position, and in this paper, I'll show some statistics for the inspectional work that is done. I'll also give some insight into what a district office looks like and how it works.

The main FDA office for the Pacific region is in Seattle (figure l), which also houses the seafood products research laboratory for FDA's field organization. Seattle has an investigations branch and a compliance branch. Most of the people that you see are from the inspection branch of the FDA, where Jim Davis is chief inspector. If you have questions about what is going on in your plant and I am not available, Jim Davis is the person to contact. Under the chief inspector, there are eight supervisors, each responsible for various programs. Chris Rezendes is a seafood monitor for the whole Pacific region. He is the most knowledgeable person in the district when it comes to seafood issues.

The Pacific Northwest should have a great deal of power in terms of the seafood industry, as shown in table 1. It can be frustrating to deal with the Washington office because of the influence that the east coast industry has on FDA decisions. The west coast, and in particular the Pacific Northwest, accounts for over 50 percent of the domestic seafood production and nearly the same amount of exports in this country. Yet, I don't believe our voice is well heard. If you look at dollar values of landings on the various ports for the United States, you see that the west coast dominates the list.

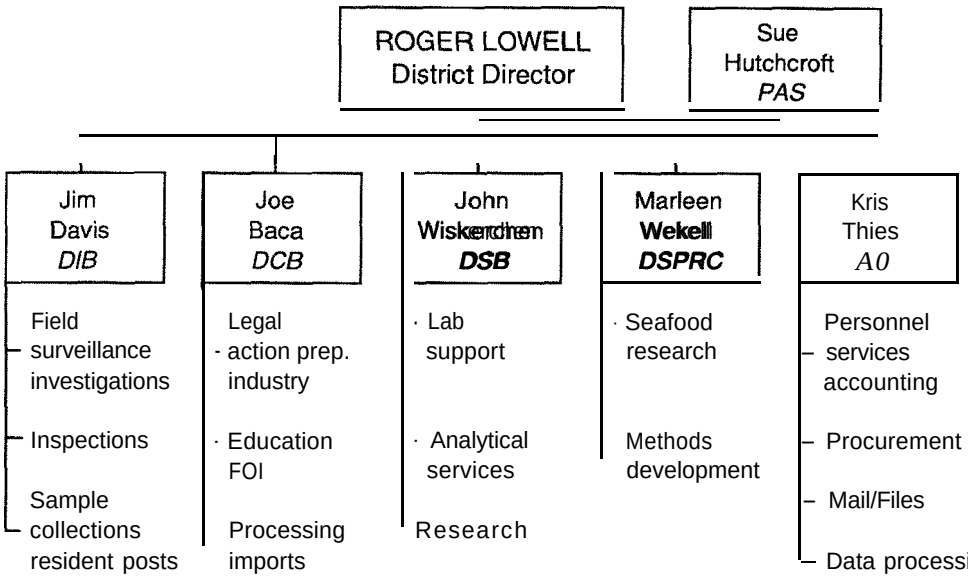

Figure 1. Pacific Region Seattle District.

When it comes to seafood regulations, our voice needs to be heard along with the voices of public opinion, the bureaucracy, and the law.

Table 1. Pacific region seafood industry: number of firms in each state.

State	No. Firms
America Samoa	2
Alaska	332
Arizona	19
California	279
Hawaii	20
Idaho	46
Montana	5
Nevada	2
Oregon	92
Washington	595

The Pacific Region, Seattle district, has 1,070 of the 1,392 firms that are registered with the FDA The official Establishment Inventory lists firm names by a central file number. The Seattle district has a great deal to say about what happens in seafood in the FDA.

Seafood firms are listed by state, with Washington leading and Alaska and California following. We can break down seafood use into establishment types as shown in table 2: (1) manufacturers (people who do something with the seafood); (2) repackers (people who take something that someone else has put together, break it into smaller entities, and repack it for retail); (3) shellfish shippers; and (4) growers (who include people in aquaculture). To put the Pacific Region Seattle district into national perspective, we can talk about the number of inspections that have been made and the percent of the national total accounted for out of this region. We account for a good share of what happens in seafood out of this region. The FDA has six regions; we are simply one of them. Our region accounts for 27 percent of the nation's inspections, 26 percent of the hours spent making those inspections, and 40 percent of the samples collected from both import status and domestic status. We do wharf exams for imports, which are just short of sampling that product. The exam is usually for labeling, but it could also be for seams on cans or other characteristics that an investigator can look at right on the dock without bringing a sample back to our laboratory.

Table 2. ***Pacific region seafood industry establishment types.***

Establishment	*No.*
Growers	103
Manufacturers	830
Repackers	583
Shell Ship	279
Other	44
Warehouses	78

Inspection classifications are assigned to firms we have inspected (figure 2). NAI means "No Action Indicated," which doesn't mean that you don't have some problem; it simply means that we are not going to take legal action against your firm. VAI-2 stands for "Voluntary Action Indicated." It indicates to us that there were more serious problems, but we anticipate that you are going to fix them. VAI-3, or "Voluntary Action Indicated," and OAI, which is "Official Action Indicated," entail receiving official written notice from us that you have a problem and that we're going to take action if you don't remedy the situation. First, we give you a warning letter describing actions you must take and requiring a response in 10 or 15 days telling us what you've

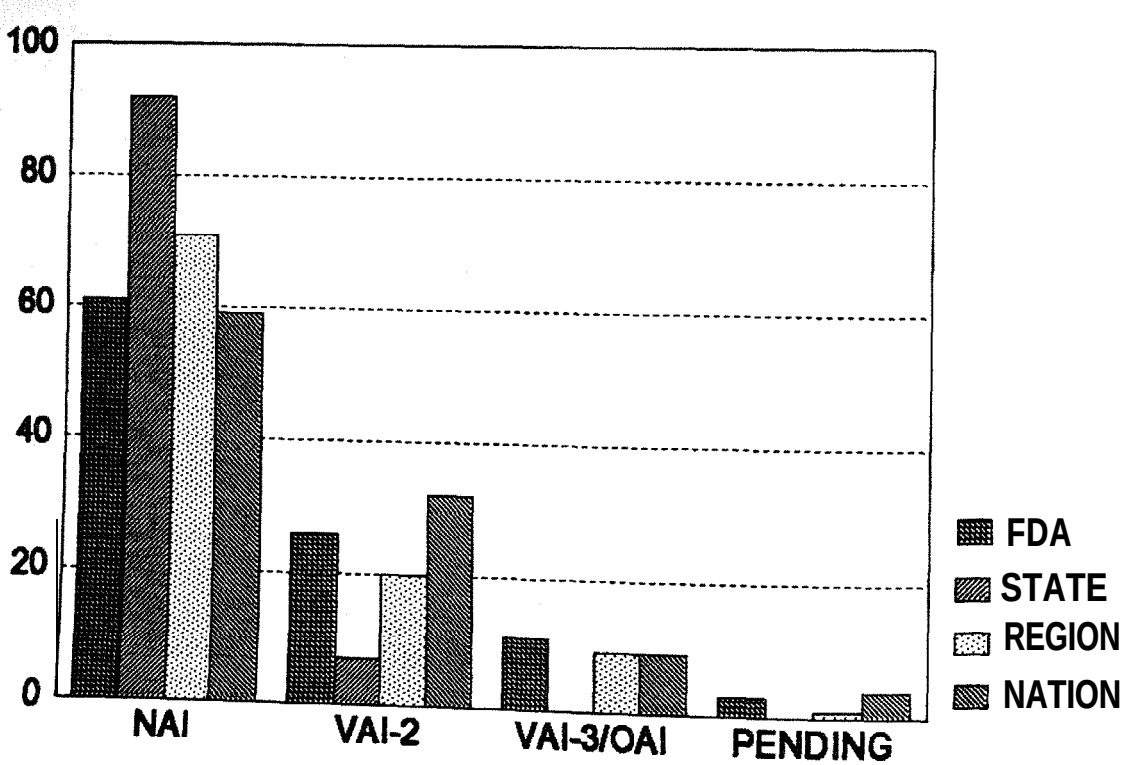

Figure 2. Pacific Region inspection classification

done. If we don't get an adequate response, we are prepared to take FDA legal actions, such as seizing product, or injunctive action against moving your product in interstate commerce, or our last resort, to prosecute. We don't have many firms in that last category, but we do have some.

Sample classifications are listed as classes 1, 2, and 3. Classes 1 and 2 are what we consider mostly in compliance. Class 3 samples are considered out of compliance. These are not surveillance samples: they do not indicate the condition of the industry. Frequently, the media and other people will pick up on our sample results and claim that 20 percent of what the FDA looks at in the seafood industry is contaminated. Where the misinformation occurs is in not understanding that these samples are targeted. We do not have enough resources to do a strict surveillance-based sampling program to show the amount of compliance in the industry. Our samples, both domestic and imported, are focused where we think there are problems. Therefore, when people look at our sample results, they can get a false image of what seafood looks like in the country.

We have a higher level of samples that we consider violative in imports. I must emphasize that these are targeted samples. We target our samples with nationwide alerts. If a sample hits New York from a particular country with something wrong, when that same product from the same country hits Seattle, I sample it. That also includes automatic detention, where a country has a reputation of giving us bad products.

Because there is often confusion over what the FDA does, I'll describe the steps of an FDA inspection. First, inspectors show up in your plant and make an inspection. At the end of the inspection, they give you the 483 form, which is a list of observations. The law mandates that we give you this list before we leave. Next, the inspector writes a report, which is reviewed by a supervisor, so it is not the inspector's opinion that is going to affect you. There are several further steps before you get in trouble. The report is given to the supervisor, and the chief inspector, Jim Davis, takes it to the compliance branch. Our compliance officers review it with national policy to see if there is a case. The compliance branch director reviews it and then I, as district director, review any action. Only the OAI violations leave our district and go to headquarters for the Office of Enforcement review, in Washington, D.C. The general counsel are not Food and Drug employees, but employees of the Department of Health and Human Services. The next step is to the U.S. Attorney. The FDA does not have police powers; we can't lock your doors. The FDA goes through the Justice Department to the federal courts before any actions are taken. There are many steps and reviews before FDA takes action against a firm.

The prohibited acts section of the Food and Drug Law is what applies to your products and the acts are mandatory. You don't have a choice in complying with these rules. The law talks about the introduction, adulteration, receipt, and interstate commerce of adulterated products. Good manufacturing practices (GMPs) are always going to be here because they are a part of the law. The hazard analysis and critical control points program (HACCP) is simply an augment to those GMPs to make them tighter. I agree that we tend to focus on HACCP, but you can't forget about GMPs. They are a part of the Food and Drug regulations. They are not being replaced by HACCP, they are simply being added.

The seafood complaints that the Seattle district gets today are the same complaints I heard 20 years ago. We still see poor employee practices, especially in moving raw material through finished product areas; that can contribute to cross contamination. Employees move from one area to another without changing clothes or sanitizing themselves before switching from handling raw product to handling finished product. This is especially important when you deal with ready-to-eat products where there is potentially *Listeria* or other pathogens.

Listeria is still a problem, especially in cold smoked fish. The east coast is enmeshed in *Listeria* from smoked fish. The district director in New York is preparing many injunctions against firms back there. Dr. Ecklund of the National Marine Fisheries is on the east coast working with the east coast industry. *Listeria* is not going to go away. People keep asking if we are going to abolish the zero tolerance level. As Tom Billy said, I do not see our changing the tolerance on *Listeria* at all.

Two years ago, we started with the incident of domoic acid in razor clams. The season was essentially closed for the entire year. Now everyone is out happily harvesting the largest razor clams they've ever seen, so maybe there was a good side to that. The next incident was finding domoic acid in crab viscera. We never did find any crab in interstate commerce from Washington and Oregon that exceeded the tolerance of 20 parts per million. We got close and had some problems especially with exports to

Japan The result of that was a meeting in San Pedro on domoic acid. This region hired a regional coordinator for domoic acid, actually for all marine toxins, to try to coordinate what the states were doing. We awarded state contracts to California, Washington, and Oregon to set up a more intricate monitoring system for domoic acid, but it didn't show up this year. Our hope for these systems is that we can close the season if domoic acid shows up rather than harvest the resource, or delay the opening of the season until the toxic levels go down. Through the work of the states and our seafood coordinator, we raised the tolerance for domoic acid in Dungeness crab viscera from 20 to 30 parts per million. That same request is being made for paralytic shellfish poisoning in crab viscera.

Paralytic shellfish poisoning is the next issue. Alaska had a great deal of trouble with paralytic shellfish poisoning in Dungeness crab vicera again this year. We had product that had to be eviscerated and sold as sections rather than as whole crab because of the toxin levels in the viscera. Alaska has drafted a monitoring program whose goal is to monitor that area and open and close the crab harvesting season to prevent crab with problems from even being harvested.

Last, I'd like to discuss the European Community (EC). The FDA intends to issue certificates to firms wishing to export to the EC. The protocol is being written and will be reviewed and distributed to industry and others for comments. You will apply to us to be placed on a list for exports to the EC. We will then review your firm's inspection records and, if applicable, the records of your state agency or of the National Marine Fisheries Service (NMFS). If necessary, we may have to reinspect your plant to update our information. If you pass these steps, other than the VAI-3 or OAI category, we will put you on a list.

When You deal with the EC, you've got to have a firm number, which you have always had from the FDA, called a central file number. We can give that list of numbers to the EC If you are on that list, you can submit filled-out certificates to us. You are going to have to give me an English version so that I can understand what I am signing. After I sign, the certificate is returned to you to accompany that shipment. I will not inspect those lots. I will sign that certificate based on the fact that you are on our list as an acceptable firm. If your buyer wants additional quality attributes or you need to have additional inspections, you are going to have to arrange for them in the same way you always have, typically, by going to NMFS and getting their lot certification for the value added part. If you fail to make our list, your choice is probably to go to NMFS, sign up for their program, and pay for the service. Once you get upgraded, you can always come back to us and ask to be reinstated.

This FDA program has to be resource neutral. I have no additional resources to run the program. If the inspection of your firm is not routinely scheduled for six to eight months from now, then I will not visit your firm until I have it regularly scheduled. If you want to get on to EC, you are going to have to have some other authority come to me and show me that your firm is in compliance. That could be the Alaska Department of Environmental Conservation, the Oregon State Department of Agriculture, the Washington State Department of Agriculture, or NOAA, but if I have to make an inspection to get you on the list, it will be done only when I'm on my routine inspection.

You need to provide specific information. You should be able to describe the HACCP program for your firm. You must be site specific. If you're a company that has five firms, I have to have a letter for each one of your sites because that is the way your firms appear in our files right now. You also have to be product specific. You must provide a contact person for each program. If you have five different plants, you can give me one contact person, but that contact person should be knowledgeable about those five sites. I also need to know what other government agencies are inspecting you, like your state's Department of Agriculture or NOAA, and when those inspections are made and who is doing that in your plant. I don't need to know about the Occupational Safety and Health Administration or the EPA. I simply need to know about those that would be germane to shipping to the EC. I need permission to look at those other records. This especially applies to NMFS. When NMFS does an inspection in your plant, that is a contract between you and them. Those records are between you and them. They are not available to me unless you tell NMFS that I can look at them.

Canned salmon has had the "canned salmon control plan" for over 70 years. This is an agreement between industry, the FDA, the Alaska Department of Environmental Conservation and the National Food Processors Association with their lab in Seattle. Everything that has been done under that plan is a

HACCP program, and we will sign certificates for shipments of firms in good standing under that plan right now. That includes the past year's production and current production. As long as you're in good standing under that plan, your canned salmon will get a certificate from the FDA.

Industry Standards in National and International Markets

THE USE OF TOTAL QUALITY PRODUCT AND TOTAL QUALITY MANAGEMENT PROGRAMS IN MEETING NEW EEC REGULATIONS

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In this paper I discuss the current status of quality certification in the French and European markets. I focus on the organization of French markets, using examples from the seafood industry.

BACKGROUND

The French Market in Europe

The French market has a dominant position in Europe for all food products, whether destined for at-home or away-from-home consumption, for three main reasons:

1. French cuisine sets the international standard for food preparation and presentation.
2. France has developed a high level of technical knowledge of both innovation and tradition in human nutrition, of which the invention of vacuum cooking by a student of the famous chef Troisgros is the best illustration.
3. The German market strongly prefers "French quality," and Germany, in all matters concerning the organization of European markets for food products, is very receptive to French proposals.

Treaties, Directives, and Regulations

The European Common Market is organized around three levels of agreements with very distinct functions:

1. The Treaty of Rome. This provides the constitution. All regulations must be in strict conformity with the Rome Treaty. As with other constitutions, the treaty text is unknown to most of those in the business world. Its real significance is revealed in the legal decisions of the European Law Court, which constantly refer to it.

2. Directives. Directives are the directions or positions established by the European Commission. These directions are not optional; each member state must set its national legislation in conformity with them. But in practice, national laws demonstrate a strong passive resistance to these directives. In addition, it is very often the jurisprudence of the European Law Court which must determine precisely which modifications will be required. For instance, a member state is not permitted to advertise the national origin of its products; thus, France is not allowed to build an advertising campaign with and about "qualité France." The passive resistance of national law, everyday practice, and the threats and sanctions of the EC Commission combine to provide the context within which the directives become regulations.

3. Regulations. These are laws. Member states are given only the time period set by the regulation itself in which to make their own laws conform to these regulations. For this reason regulations encounter much less passive resistance from national law and practice than do directives.

The Use of Standards

The primary function of a standard is to provide security to transactions made over a distance. It is the industrial world that has contributed the most to the definition and propagation of the standards that support and guarantee contractual relationships between firms placing orders and those that carry them out, or their subcontractors. Inherent in a standard is reference to a sale contract, that is, the given commercial practice at a given time concerning the exchange of merchandise. The merchandise itself functions as a support for the system which allows the individuals concerned with the exchange to make the necessary profits.

In regard to human nutrition, the development of standards is much more recent, for two main reasons. First, the definition of what constitutes human food is complex, with a strong cultural component. The constant change that characterizes technology and culture presents an ongoing challenge to this definition. Second, tradition is efficient, which is to say that expectations of "fair and customary use" provide the main guarantee, at the national level, of the success of food products sales.

I should emphasize that the safety of a food (the first priority of every regulation) is only the first step toward consumer satisfaction, which is the real driving force behind every exchange involving food products. Safety is an implicit expectation of consumers. But consumer expectations are evolving and vary from one country to another, as do the methods of satisfying them. Since each market can refer, in good faith, to its own tradition of "fair and customary use," a preoccupation with legal protections has arisen in the competition between EC members. In the hope of improving credibility and protection, economic partners will demand more and more sophisticated proof of facts that support the fairness of allegations and the safety of common food uses.

Fundamental to understanding the current evolution of the EC regulations concerning quality certification are the specific requirements of human nutrition. It is equally important to keep in mind the essential function of a standard, whatever this standard might be: to provide security to an economic transaction from a distance.

The "New Approach" and the *Cassis de Dijon Case*

The requirement of free circulation of goods between member states of the EC affects every product. When the unifying act was signed, it was technically impossible to define a full set of regulations guaranteeing free trade within a short period. This is why the "New Approach" directives were adopted. These directives are limited to the essentials, leaving the working out of technical details to the standardization process (or, as we shall discuss further, the "professional approach"). The object of having these directives come into force simultaneously in each national legal system is to set up an "automatic" harmonization process among these systems. The application schedule of these New Approach directives is determined by the goods' complexity, to allow time for concerned firms to gather correct information and to adapt their production processes to EC standards.

The directive of 22 July 1991 (see appendix), fixing the sanitation regulations for production and trade of seafood products, is typical of the "New Approach." To make it easier for readers to understand the following discussion, I advise them to take a break for a careful reading of this directive, integrating the information provided above before going on. (This advice is in fact a directive, since the contents of the July 22 1991 directive will be referred to below without further citation than the article number).

At the same time as the New Approach was defining a method of harmonizing various types of "fair and customary uses," the outcome of the *Cassis de Dijon* case nipped in the bud the protectionist tendencies embodied within various national legal interpretations of "fair and customary use." This case merits further examination in order to elucidate the essential common rights it established.

In the 1970s a German importer was refused authorization to import *Cassis de Dijon* into Germany. The reason: the alcoholic content of *Cassis de Dijon* is 18%, and only alcoholic beverages with a minimum alcoholic content of 32% are allowed to be called "Cassis" for sale in Germany. This national law conformed to what was considered "fair and customary use" in the German market. German authorities took the position commonly held by all member states at that time in cases not covered by EEC regulations: a national law that forbids the trade of a product, whether processed locally or imported, concerns EC products too, as there should be no discrimination between the treatment of domestic and community goods. The European Law Court refuted this position by affirming that any product legally processed and traded in one of the member states, must, in principle, be allowed in trade in every other member state.

This case set a precedent confirming one of the fundamental principles of the Rome Treaty: free circulation of goods. It further introduced an equivalence between the "fair and customary uses" of different member states. In so doing it established an initial practice that is the basis of the lowest common denominator of the food trade: the less demanding "usage" must be allowed in as far as the relevant authority allows it.

The New Approach and the *Cassis de Dijon* case established also, as a corollary, a clear responsibility on the part of the processor as a prerequisite to any transaction. It is the establishment of the processor's credibility which is the goal of the development of quality certification systems.

Defining Concepts: Competent Authority

The dictionary offers two different meanings for the term *quality:*

1. what it is that makes a thing what it is (with reference to final uses)

2. the excellence inherent in something (with reference to ethical considerations)

Food consumers' expectations can be based on one or both of these concepts. Food technologists and industry concern themselves primarily with the first concept; consumers and traders with the second. The fact that the EC's "competent authority" should be composed of veterinary technicians (article 2 directive 91/493) provides a clear indication of the kind of certification expected from a firm: it consists essentially of its capacity to organize and guarantee the processes within the competent authority's charge (article 6 directive 91/493).

We now turn to the general context of firm certification, or a firm's quality assurance systems, as an implicit element of the New Approach to the approval of firms (article 7 directive 91/493). As I will discuss later, the oversight of this implicit trend of European Community regulation is managed in France through applications initiated by AFAQ (Association Française pour l'Assurance Qualité). However, as a preamble, I must emphasize that this is a trend and not a legal obligation.

We have already mentioned the effect of the inertia of national laws on EC directives. This is even more important in cases of quality assurance applications, In such cases, the inertia is strengthened by the perverse effects of the *Cassis de Dijon* case, which concerns de facto the former French colonies in Africa (through the Lomé convention), thus allowing very low-quality goods into the EC. Some French processors actually seek trade in such goods or use them as inputs in their production processes to diversify their sources of profit. Several examples of such behavior are famous on the canned fish market, including sardines in oil, anchovy fillets, and canned tuna A good part of the turnover of this sector comes from low-quality product imported by small French processors and sold under their own brand names.

At the opposite end of the scale, large processors such as SAUPIQUET anticipated the evolution of the regulations and have already certified their own quality assurance systems to ISO 9000 standards. In fact, there is currently a clear split between two categories of operators in France:

- firms that anticipated regulatory evolution and are involved in certification of their quality assurance processes
- firms that are unaware of this evolution or wish to profit from current regulatory distortions of free competition and free circulation of goods

Limits of the Current System: an Example of Regulatory Distortion

It is generally accepted that it is the large firms that will be most concerned with certifying their quality assurance systems. The following example concerns a large distribution firm with a quality assurance program that trades seafood products under its own brand name, imported from Denmark as fresh products with a nine-month shelf life. There is currently a strong demand in France for all seafood sold fresh, especially in the *saurisserie,* or smoked foods, department: smoked fish, taramas, snack products, fish fritters, and so on.

For products or meals prepared in advance and sold as fresh, French regulations allow French processors to indicate, following precise procedures, a shelf life date of 21 days for vacuum cooked products and 42 days for pasteurized products. Processors are not allowed to claim a shelf life of over 42 days for fresh or processed seafood (article 2 directive 91/493), except for "semiconserves." For these products, the minimum shelf life is over two weeks, due to the use of conservation techniques indicated on the label. Danish products imported and traded under this distributor's brand name are effectively sold in the fresh department as "semiconserves," with instructions to keep them at 8 degrees Celsius. Last year they were sold as canned.

This example and others are very well known among French processors, and some of them are actually trying to define new lines of "fresh canned products" for sale under the current regulatory loophole.

TOTAL QUALITY MANAGEMENT

IS0 9000 Standards

Certification of quality assurance systems originated mainly within the customer-supplier relationship. A customer, having certain specifications for a product, would seek out suppliers who could meet these specifications and purchase only from those suppliers. Certificates attesting to the suppliers' ability to meet specifications could be granted either by an independent organization (third-party certification) or directly by the buyer or distributor (second-party certification). Various terms of reference can be used in

these two cases. In the case of third-party certification, ISO 9000 standards are usually used, for easier recognition both of the certifying body specializing in these standards and for the certified firm's use in communicating internationally known references.

The definition of quality assurance in ISO 9000 standards is as follows, roughly translated into English: "the combination of preestablished and systematic actions necessary to give appropriate confidence that a product or service will satisfy requirements related to quality," these requirements being "the combination of properties and characteristics of a service or product which confer upon it the ability to satisfy expressed or implicit needs."

It must be noted that the notion of quality is defined here in its wider sense, including all the expectations of the concerned public, without specifying a particular level of quality. It must be emphasized as well that it is the firm itself which selects the set of preestablished processes that are to be verified, processes that will be established through its own technical expertise in quality management. Also, it can only be a voluntary effort, indicative of both the firm's management expertise and of the quality of production due to this management. The voluntary nature of this approach presumes a clarity of objectives within the firm necessary to mobilize the staff to realize these objectives.

Third-party certification of quality assurance systems under ISO 9000 thus functions as a management tool attesting to a highly effective level of management. It is this tool and this level that give the processor credibility, even from a distance. The function of ISO 9000 standards, like that of every set of standards, is effectively to give security to a transaction from a distance.

The Relationship Between Distributors and Processors: Competent Authority and Current Developments in France

At the moment, most distributors who want to distribute goods under their own brand name accord limited importance to third-party certification of their quality assurance systems, preferring their own controls to those of an independent organization. The current level of development of trade standards embodied in directive 91/493 allows distributors to impose commercial pressure in the guise of second-party certification "standards," at very low cost to themselves. However, the inevitable trend is toward independently imposed standards originating with an international certification body that will ensure the independence of the manufacturer from the distributor of the manufacturer's product. French processors know very well that without third-party ISO-9000 certification, they risk being submitted to arbitrary audits on the part of their foreign customers, which in some cases could be an ill-disguised effort to create barriers to free trade.

The best ally of the French processor, and those in the EC or other countries, is the competent authority in France that deals with community regulations: the state veterinary services. The veterinary services in charge of hygiene and food safety in France are powerful and efficient. Their actions are founded, according to "fair and customary use," on allowing processors to be progressively more responsible for setting up and verifying quality-control processes. This means that overall, French authorities have responded positively to the increasing complexity of production techniques (for example, "4th range" and vacuum cooking) and the rising level of quality assurance requirements. From the beginning, the French have accepted the challenge of combining voluntary efforts and the legal obligations put upon them by France and the EC.

Indeed, everyone - firms, administrators, and experts-knows that at the beginning, the process of firm certification will be long and difficult, but that quality certification, though it is not a miracle drug, is the single best way to meet the managerial needs inextricably linked to the long-term satisfaction of consumers in developed nations.

The French Quality Assurance Association (AFAQ) and the National Testing Network (RNE

Many industrial applications of quality assurance certification led to the creation, in 1988, of AFAQ, constituted by three "collèges":

collège A: AFNOR and professional sales organizations
collège B: buyers
collège C: technical controllers

AFAQ certification, like every standardization process, requires an interdisciplinary professional approach. AFAQ certification is based on international standard practices:

- standard 45012 for a firm's own management
- IS0 9000 standards applied to firms

. ISO 10011 standards for selection of experts

The final objective of this professional orthodoxy is to facilitate agreements between and partnerships with firms certified by other analogous certification centers, to improve the relationship between customers and suppliers. This kind of partnership already exists between German, Canadian, and Swiss bodies. Although AFAQ has no ambition to take control of international certification, it is clear that all significant firm certification programs currently being tested in France are aimed toward achieving AFAQ certification.

Created in 1979, th Rèseau National d'Essais (National Testing Network) manages accreditation of laboratories to the EN 45001 standard according to detailed requirements for accredited laboratories and candidates for accreditation. Accreditation of a laboratory is the formal recognition of its ability to undertake specified tests and to ensure the quality of these tests. The political purpose of the RNE is to set up a network of similar organizations in other countries to establish more consistent standards between competent authorities.

Food Security

It is not by chance that the food security theme accompanied the complete set of common agricultural policy reforms. The entire policy was systematically linked to the establishment of professional strategies in quality certification, in all sectors. It is not possible to limit the free circulation of goods and services, but the increasing concern with health and safety by consumers in developed countries goes hand in hand with the increasing challenge to firms in developed countries to maintain their market positions. Certification of quality assurance systems is clearly the key to future access to EC markets for firms in developed countries.

TOTAL QUALITY PRODUCT

Specialty Foods

Certification systems for quality assurance mainly concern large industrial firms of the agro-food sector, producing goods for mass consumption. But many French producers famous for the quality of their product are very small firms, often "artisan" sized. This is particularly true for such products as wines, cheeses, poultry, red meat, pork specialties, and regional specialties such as Cassoulet de Castelnaudary.

At the national level, these specialty products are subject to a double set of consumer-recognized certifications:

- a certificate of higher quality indicated by the authorization to stamp the product Label Rouge (Label Rouge is a national collective brand name for higher quality foods; in French the word label connotes quality and not information requirements)
- a certificate of regional specialty attested to by the indication Appellation d'Origine Contrôlée (specified origin label or AOC).

Usually, certification by one of these methods precludes certification by the other, and thus products given the Appellation d'Origine Contrôlée would not also be certified with the Label Rouge. The Appellation d'Origine Contrôlée is reserved for products or processes giving proof of a strong historic tradition and precedence in setting a special or high-quality standard. The Appellation d'Origine Contrôlée concerns mainly wines and cheeses. Quality here refers essentially to bioclimatic conditions or traditional, often secret, technical knowledge.

Label Rouge concerns any superior-quality product. In order to be granted this label, a producer must adhere to precise terms of reference, explaining what differentiates it from generic products and justifying its higher price. Proof must be offered that this product of superior quality is produced in significant quantity (this was the main issue of contention in providing Scottish salmon with the Label Rouge).

The terms of reference for foods certified with the Label Rouge are public. The registration of these terms of reference is done by an independent certification organization using the 45011 standard. So, for products certified "Label Rouge," our general definition of quality is met: the following of preestablished procedures, with verification.

As this was not necessarily the case for Appellation d'Origine Contrôlée there has for a long time been a kind of philosophical opposition between the approaches followed by the Institut National des Appellations d'Origine (which focuses on tradition and French *art de vivre*) and the Commission Nationale des Labels (which focuses on consumer expectations). Each of these organizations has been lobbying Brussels for at least five years to publish

directives or rules allowing it to determine the professional methods for certifying the quality of foods at the EEC level.

The Rule of 14 July 1992 on Agro-Food Specialties and the Rule of 14 July 1992 on Protection of Geographic Indications and Origin Appellations of Food Products

Rather than choose between the methods proposed by the two organizations, the EEC Commission permitted both, with these two closely related rules. The rule about food specialties is no more than the elevation to the EC level of the French Label Rouge. However "specialty," in the rule, is not limited to superior quality for this type of product. Further, the harmonizing of the EEC register of recognized specialties between member states and producer groups has been difficult and complex, although the register has been adapted to changes in the terms of reference on which specialties are based. And, in order to maintain superior-quality levels, these changes are strictly necessary.

The rule about protected geographic indications mentions terms of reference as well (article 4 of the rule), explicitly the "description of the method of obtaining the agricultural or food product, and where relevant the fair and customary practices."

These two rules have two points in common:

- the professional character of each method, managed by concerned professional groups
- the obligation of every member of the professional group to submit to the control of an independent certification body using the 45011 standard, valid to 1998 at the latest

Standard EN 45011 specifies criteria that must be met by a certification organization before the certification of products, in order to be recognized at the EC level as competent and reliable to set up such a certification system, whatever the concerned sector might be. The 1998 limit date on anything concerning the 45011 standard of certifying organizations for food specialties and origin appellations is connected with article 17 of directive 91/493

The Redeployment of Professional Organizations

These two rules will come into force next July and will certainly allow a new deployment of the largest French professional organizations, which have been crippled for a long time because of the illegal origin of their income (national obligatory parafiscal taxes). Indeed, there are strong similarities between the objectives of professional organizations and those of certification organizations.

In France, the goals of agro-food trade organizations are those which the individual firm cannot assume alone, including

- collective research and development
- collective promotion and advertising
- procedures and controls

These are also the goals of certification organizations dealing with producers who have already achieved the 45011 standards as well as those who have attained the "Label Rouge."

The Challenge for "Peripheral" Agriculture

A few years ago, there was a clear distinction between the "agro-industrial," or profit-making agricultural sector (milk, corn, and so on), and agricultural products from the peripheral regions, especially from the Mediterranean zone. At that time food security strategies concerned production only in these peripheral zones, while other producers had to compete in international markets around the world.

Recent developments show that this assumption was mistaken and that food security strategies concern the entire European agro-industrial sector. In this context it was imperative to immediately develop effective tools (rules) which would allow differential marketing for products from peripheral zones. Putting these rules into practice will be just as important as putting into place the new regulations tied to the common agricultural policy.

Perspectives for Other Countries

It is likely that the application of these two rules will be extended to agro-food products of non-EC states that are able to guarantee quality assurance practices equivalent to those in the EC and in which the competent certifying authority meets 45011 standards. These regulations could provide an excellent and useful tool for third-country professional groups to meet quality challenges, by furthering their understanding of the current evolution of EC food product quality management practices.

Appendix

COUNCIL DIRETTIVE

of 22 July 1991

laying down the health conditions for the production and the placing on the market of fishery products

(91/493/EEC)

THE COUNCIL OF THE EUROPEAN COMMUNITIES,

Having regard to the Treaty establishing the European Economic Community, and in particular Article 43 thereof,

Having regard to the proposals from the Commission (1),

Having regard to the opinions of the European Parliament (2),

Having regard to the opinions of the Economic and Social Committee (3),

Whereas, with a view to achieving the internal market and more especially to ensuring the smooth operation of the common organization of the market in fishery products established by Regulation (EEC) No 3796/81 (4), as last amended by Regulation (EEC) No 2886/89 (5), it is essential that the marketing of fish and fish products should no longer be hindered by disparities existing in the Member States in respect of health requirements; whereas this will enable production and placing on the market to be better harmonized and bring about competition on equal terms, whilst ensuring quality products for the consumer;

Whereas the European Parliament in its legislative resolution of 17 March 1989 (6) requested the Commission to come forward with comprehensive proposals on the hygienic production and placing on the market of fishery products, including solutions for the problem of nematodes;

Whereas fishery products freshly caught are in principle free of contamination with micro-organisms; whereas however contamination and subsequent decomposition may occur when handled and treated unhygienically;

Whereas therefore the essential requirements should be laid down for the correct hygienic handling of fresh and processed fishery products at all stages of production and during storage and transport;

Whereas it is appropriate to apply by analogy certain marketing standards which are laid down pursuant to Article 2 of Regulation (EEC) No 3796/81, in order to fix the health quality of these products;

Whereas it is the responsibility primarily of the fisheries industry to ensure that fishery products meet the health requirements laid down in this Directive;

Whereas the competent authorities of the Member States must, by carrying out checks and inspections, ensure that producers and manufacturers comply with the said requirements;

Whereas Community control measures should be introduced to guarantee the uniform

Reprinted with permission of the European Communities from the Official *Journal of the European Communities*, L 268,24.9.91, p 15.

(1) OJ No C 66 , 11.3. 1988, p. 2; OJ No C 282,8.11.1989 p. *7* and OJ No C 84, 2.4. 1990, p. 56.
(2) OJ No C 96,17.4.1989, p. 29 and OJ No C 183,15. 7. 1991.
(3) OJ No C 134,24.5.1988, p. 31 and OJ No C 332,31. 12. 1990, p. *59*.
(4) OJ No L 379, 31. 12. 1981, p. 1.
(5) OJ No L *282,2*. 10. 1989, p. 1.
(6) OJ No C 96, 17.4. 1989, p. 199.

application in all Member States of the standards laid down in this Directive;

Whereas, in order to ensure the smooth operation of the internal market, the measures should apply in an identical manner to trade within the Member States and to trade between the Member States;

Whereas in the context of intra-Community trade, the rules laid down in Council Directive 89/662/EEC of 11 December 1989 concerning veterinary checks in intra-Community trade with a view to the completion of the internal market (7) as amended by Directive 90/675/EEC (8) apply to fishery products;

Whereas fishery products from third countries intended to be placed on the market of the Community must not qualify for more favourable arrangements than those applied in the Community; whereas provision should therefore be made for a Community procedure for the inspection in third countries of the conditions of production and placing on the market in order to permit the application of a common import system based on conditions of equivalence;

Whereas the products in question are subject to the rules concerning checks and to safeguard measures covered by Council Directive 90/675/EEC of 10 December 1990 laying down the principles governing the organization of veterinary checks on products entering the Community from third countries;

Whereas, so that account may be taken of particular circumstances, derogations should be granted to some establishments already operating before 1 January 1993 so as to allow them to adapt to all the requirements laid down in this Directive;

Whereas the Commission should be entrusted with the task of adopting certain measures for implementing this Directive; whereas, to that end, procedures should be laid down introducing close and effective cooperation between the Commission and the Member States within the Standing Veterinary Committee;

Whereas the essential requirements laid down in this Directive may need further specification,

HAS ADOPTED THIS DIRECTIVE

CHAPTER 1

General provisions

Article 1

This Directive lays down the health conditions for the production and the placing on the market of fishery products for human consumption.

Article 2

For the purposes of this Directive, the following definitions shall apply:

1. *'fishery products'* means all seawater or freshwater animals or parts thereof, including their roes, excluding aquatic mammals, frogs and aquatic animals covered by other Community acts;

2. *'aquaculture products'* means all fishery products born and raised in controlled conditions until placed on the market as a foodstuff However seawater or freshwater fish or crustaceans caught in their natural environment when juvenile and kept until they reach the desired commercial size for human consumption are also considered to be aquaculture products. Fish and crustaceans of commercial size caught in their natural environment and kept alive to be sold at a later date are not considered to be aquaculture products if they are merely kept alive without any attempt being made to increase their size or weight;

3. 'chilling' means the process of cooling fishery products to a temperature approaching that of melting ice;

4. "fresh products' means any fishery product whether whole or prepared, including products packaged under vacuum or in a modified atmosphere, which have not undergone any treatment to ensure preservation other than chilling;

(7) OJ No L395,30.12.1989,p.13.
(8) OJ No L 373,31.12.1990,p.1.

5. 'prepared products' means any fishery product which has undergone an operation affecting its anatomical wholeness, such as gutting, heading, slicing, filleting, chopping, etc.;

6. 'processed products' means any fishery product which has undergone a chemical or physical process such as the heating, smoking, salting, dehydration or marinating, etc., of chilled or frozen products, whether or not associated with other foodstuffs, or a combination of these various processes;

7. *'preserve'* means the process whereby products are packaged in hermetically sealed containers and subjected to heat treatment to the extent that any micro-organisms that might proliferate are destroyed or inactivated, irrespective of the temperature at which the product is to be stored;

8. *'frozen products'* means any fishery product which has undergone a freezing process to reach a core temperature of – 18°C or lower after temperature stabilization;

9. *'packaging'* means the procedure of protecting fishery products by a wrapper, a container or any other suitable device;

10. *'batch'* means the quantity of fishery products obtained under practically identical circumstances;

11. *'consignment'* means the quantity of fishery products bound for one or more customers in the country of destination and conveyed by one means of transport only;

12. *'means of transport'* means those parts set aside for goods in automobile vehicles, rail vehicles and aircraft, the holds of vessels, and containers for transport by land, sea or air;

13. *'competent authority'* means the central authority of a Member State competent to carry out veterinary checks or any authority to which it has delegated that competence;

14. *'establishment'* means any premises where fishery products are prepared, processed, chilled, frozen, packaged or stored. Auction and wholesale markets in which only display and sale by wholesale takes place are not deemed to be establishments;

15. *'placing on the market'* means the holding or displaying for sale, offering for sale, selling, delivering or any other form of placing on the market in the Community, excluding retail sales and direct transfers on local markets of small quantities by fishermen to retailers or consumers, which must be subject to the health checks laid down by national rules for checking the retail trade;

16. *'importation'* means the introduction into the territory of the Community of fishery products from third countries;

17. *'clean seawater'* means seawater or briny water which is free from microbiological contamination, harmful substances and/or toxic marine plankton in such quantities as may affect the health quality of fishery products and which is used under the conditions laid down in this Directive;

18. *'factory vessel'* means any vessel on which fishery products undergo one or more of the following operations followed by packaging: filleting, slicing, skinning, mincing, freezing or processing.

The following are not deemed to be factory vessels:

- fishing vessels in which only shrimps and molluscs are cooled on board,
- fishing vessels on board which only freezing is carried out.

Article 3

1. The placing on the market of fishery products caught in their natural environment shall be subject to the following conditions:

(a) they must have:

(i) been caught and where appropriate handled for bleeding, heading, gutting and the removal of fins, chilled or frozen, on board vessels in accordance with hygiene rules to be established by the Council acting by a qualified majority on a proposal from the Commission. The Commission shall submit proposals to that effect before 1 October 1992;

(ii) where appropriate, been handled in factory vessels approved in accordance with Article 7, and in accordance with the requirements of Chapter I of the Annex.

The cooking of shrimps and molluscs on board must comply with the provisions of Chapter III, section I(5), or Chapter IV, section IV(7), of the Annex. Such vessels shall be specifically registered by the competent authorities;

(b) during and after landing they must have been handled in accordance with Chapter II of the Annex;

(c) they must have been handled and, where appropriate, packaged, prepared, processed, frozen, defrosted or stored hygienically in establishments approved in accordance with Article 7, in compliance with the requirements of Chapters III and IV of the Annex.

The competent authority may, notwithstanding Chapter II, section 2 of the Annex, authorize the transfer of fishery products ex quay into containers for immediate delivery to an approved establishment or registered auction or wholesale market to be checked there;

(d) they must have undergone a health check in accordance with Chapter V of the Annex;

(e) they must have been appropriately packaged in accordance with Chapter VI of the Annex;

(f) they must have been given an identification mark in accordance with Chapter VII of the Annex;

(g) they must have been stored and transported under satisfactory conditions of hygiene, in accordance with Chapter VIII of the Annex.

2. Where gutting is possible from a technical and commercial viewpoint, it must be carried out as quickly as possible after the products have been caught or landed.

3. The placing on the market of aquaculture products shall be subject to the following conditions:

(a) they must have been slaughtered under appropriate conditions of hygiene. They must not be soiled with earth, slime of faeces. If not processed immediately after having been slaughtered, they must be kept chilled;

(b) they must, in addition, comply with the requirements laid down under 1 (c) to (g).

4. (a) The placing on the market of live bivalve molluscs shall be subject to the requirements laid down in Council Directive 91/492/EEC of 15 July 1991 laying down the health conditions for the production and the placing on the market of live bivalve molluscs (1).

(b) When processed, bivalve molluscs must, in addition to the requirements in point (a), satisfy those of paragraph 1 (c) to (g).

Article 4

Fishery products to be placed on the market alive shall at all times be kept under the most suitable survival conditions.

(1) See page 1 of this Official Journal.

Article 5

The placing on the market of the following products shall be forbidden:

— poisonous fish of the following families: *Tetraodontidae, Molidae, Diodontidae, Canthigasteridae,*

— fishery products containing biotoxins such as ciguatera toxins or muscle-paralysing toxins.

Detailed requirements concerning the species covered by this Article and concerning methods of analysis shall be laid down in accordance with the procedure prescribed in Article 15.

Article 6

1. Member States shall ensure that persons responsible for establishment take all necessary measures, so that, at all stages of the production of fishery products, the specifications of this Directive are complied with.

To that end, the said persons responsible must carry out their own checks based on the following principles:

— identification of critical points in their establishment on the basis of the manufacturing processes used;

— establishment and implementation of methods for monitoring and checking such critical points;

— taking samples for analysis in an approved laboratory by the competent authority for the purpose of checking cleaning and disinfection methods and for the purpose of checking compliance with the standards established by this Directive;

— keeping a written record or a record registered in an indelible fashion of the preceding points with a view to submitting them to the competent authority. The results of the different checks and tests will in particular be kept for a period of at least two years.

2. If the results of own checks or any information at the disposal of the persons responsible referred to in paragraph 1 reveal the risk of a health risk or suggest one might exist and without prejudice to the measures laid down in the fourth subparagraph of Article 3 (1) of Directive 89/662/EEC, the appropriate measures shall be taken, under official supervision.

3. Rules for the application of the second subparagraph of paragraph 1 shall be established in accordance with the procedure laid down in Article 15.

Article 7

1. The competent authorities shall approve establishments once they have verified that these establishments meet the requirements of this Directive, with regard to the nature of the activities they carry out. The approval must be renewed if an establishment decides to carry out activities other than those for which it has received approval.

The competent authorities shall take the necessary measures if the requirements cease to be met. To this end, they shall take particular account of the conclusions of any check carried out in accordance with Article 8.

The competent authority shall register those auction and wholesale markets which are not subject to approval after verifying that such installations comply with the provisions of this Directive.

2. However, subject to the express condition that products coming from factory-vessels and establishments, auction and wholesale markets meet the hygiene standards set by this Directive, Member States may, for the requirements relating to equipment and structures laid down in Chapters I to IV to the Annex, grant to factory-vessels and establishments, auction and wholesale markets a further period expiring on 31 December 1995 within which to comply with the conditions of approval set out in Chapter IX. Such derogations may be granted only to factory-vessels and establishments, auction and wholesale markets, already operating on 31 December 1991, which have, before 1 July 1992, submitted a duly justified application for derogation to the competent national authority. This application must be accompanied by a work plan and programme indicating the period within which

it would be possible for them to comply with the requirements in question. Where financial assistance is requested from the Community, only requests in respect of projects complying with the requirements of this Directive can be accepted.

3. The competent authorities shall draw up a list of their approved establishments, each of which shall have an official number.

Each Member State shall notify the Commission of its list of approved establishments and of any subsequent amendment thereof. The Commission shall forward this information to the other Member States.

4. The inspection and monitoring of establishments shall be carried out regularly under the responsibility of the competent authority, which shall at all times have free access to all parts of establishments, in order to ensure compliance with the requirements of this Directive.

If such inspections and monitoring reveal that the requirements of this Directive are not being met, the competent authority shall take appropriate action.

5. Paragraphs 1,3 and 4 shall also apply in respect of factory vessels.

6. paragraphs 3 and 4 shall also apply to wholesale and auction markets.

Article 8

1. Experts from the Commission may, in cooperation with the competent authorities of the Member States, make on-the-spot checks insofar as this is necessary to ensure the uniform application of this Directive. They may in particular verify whether establishments are in effect complying with the requirements of this Directive. A Member State in whose territory a check is being carried out shall give all necessary assistance to the experts in carrying out their duties. The commission shall inform the Member States of the results of the investigations.

2. The arrangements for implementing paragraph 1 shall be adopted in accordance with the procedure laid down in Article 15.

Article 9

1. The rules laid down in Directive 89/662/EEC, as regards fishery products intended for human consumption, shall apply, in particular as regard the organization of and the action to be taken following the inspections to be carried out by the Member States of destination, and the protective measures to be implemented.

2. Directive 89/662/EEC shall be amended as follows:

(a) in Annex A the following indent shall be added:

'— Council Directive 91/493/EEC of 22 July 1991 laying down the health conditions for the production and placing on the market of fishery products (OJ No L 268, 24.9. 1991, p. 15);

(b) in Annex B the following indent shall be deleted:

'— fishery products intended for human consumption'.

CHAPTER II

Imports from third countries

Article 10

Provisions applied to imports of fishery products from third countries shall be at least equivalent to those governing the production and placing on the market of Community products.

Fishery products caught in their natural environment by a fishing vessel flying the flag of a third country must undergo the checks laid down in Article 18 (3) of Directive 90/675/EEC.

Article 11

1. For each third country or group of third countries, fishery products must fulfil the specific import conditions fixed in accordance with the procedure laid down in Article 15, depending on the health situation in the third country concerned.

2. In order to allow the import conditions to be fixed, and in order to verify the conditions of production, storage and dispatch of fishery products for consignment to the Community, inspections may be carried out on the spot by experts from the Commission and the Member States.

The experts of the Member States who are to be entrusted with these inspections shall be appointed by the Commission acting on a proposal from the Member States.

These inspections shall be made on behalf of the Community, which shall bear any expenditure incurred.

The frequency of and procedure for these inspections shall be determined in accordance with the procedure laid down in Article 15.

3. When fixing the import conditions of fishery products referred to in paragraph 1, particular account shall be taken of:

(a) the legislation of the third country;

(b) the organization of the competent authority of the third country and of its inspection services, the powers of such services and the supervision to which they are subject, as well as their facilities for effectively verifying the implementation of their legislation in force;

(c) the actual health conditions during the production, storage and dispatch of fishery products intended for the Community;

(d) the assurances which a third country can give on the compliance with the standards laid down in Chapter V of the Annex.

4. The import conditions referred to in paragraph 1 shall include:

(a) the procedure for obtaining a health certificate which must accompany consignments when forwarded to the Community;

(b) the placing of a mark identifying the fishery products, in particular with the approval number of the establishment of origin, except in the case of frozen fishery products, landed immediately for canning and bearing the certificate provided for under (a);

(c) drawing up a list of approved establishments and auction or wholesale markets registered and approved by the Commission in accordance with the procedure laid down in Article 15;

For that purpose, one or more lists of such establishments shall draw up on the basis of a communication from the competent authorities of the third country to the Commission. An establishment may not appear on a list unless it is officially approved by the competent authority of the third country exporting to the Community. Such approval shall be subject to observance of the following requirements:

— compliance with requirements equivalent to those laid down in this Directive,

— monitoring by an official inspection service of the third country.

5. The conditions referred to in paragraph 4 (a) and (b) may be modified in accordance with the procedure laid down in Article 15.

The list referred to in paragraph 4 (c) may be amended by the Commission, in accordance with the rules established by Commission Decision 90/13/EEC (1).

6. To deal with specific situations and in accordance with the procedure laid down in Article 15, imports may be authorized direct from an establishment or factory vessel of a third country where the latter is unable to provide the guarantees laid down in paragraph 3, provided that the establishment or factory vessel in question has received special approval following an inspection carried out in accordance with paragraph (2). The authorization decision shall fix the specific import conditions to be followed for products coming from that establishment or factory vessel.

7. Pending the fixing of the import conditions referred to in paragraph 1, the Member States shall ensure that the conditions applied to imports of fishery products from third countries shall be at least equivalent to those governing the production and placing on the market of Community products.

(l) OJ No L 8,11. 1. 1990, p. 70.

Article 12

1. The rules and principles laid down by Directive 90/675/EEC shall apply, notably as regards the organization of and follow up to the inspections to be carried out by the Member States.

2. Without prejudice to compliance with the rules and principles referred to in paragraph 1 of this Article and pending implementation of the decisions provided for in Article 8 (3) and Article 30 of Directive 90/675/EEC, and in Article 11 of this Directive the relevant national rules for applying Article 8 (1) and (2) of the said Directive shall continue to apply.

CHAPTER III

Final Provisions

Article 13

The Annexes shall be amended by the Council, acting by a qualified majority on a proposal from the Commission.

Article 14

The Commission, after consulting the Member States, shall by 1 July 1992 submit a report to the Council concerning the minimum structural and equipment requirements to be met by small establishments which distribute on the local market and are situated in regions subject to particular supply constraints, together with any proposals, on which the Council, acting under the voting procedure laid down in Article 43 of the Treaty, shall act before 31 December 1992.

Article 15

1. Where the procedure laid down in this Article is to be followed, the Chairman shall refer the matter to the Standing Veterinary Committee set up by Decision 68/361/EEC (2) hereafter referred to as the Committee, either on his own initiative or at the request of a Member State.

2. The representative of the Commission shall submit to the committee a draft of the measures to be taken. The committee shall deliver its opinion on the draft within a time limit which the chairman may lay down according to the urgency of the matter. The opinion shall be delivered by the majority laid down in Article 148 (2) of the Treaty in the case of decisions which the Council is required to adopt on a proposal from the Commission. The votes of the representatives of the Member States within the committee shall be weighted in the manner set out in that Article. The chairman shall not vote.

3. (a) The Commission shall adopt the measures envisaged if they are in accordance with the opinion of the committee.

(b) If the measures envisaged are not in accordance with the opinion of the committee, or if no opinion is delivered, the Commission shall, without delay, submit to the Council a proposal relating to the measures to be taken. The Council shall act by a qualified majority.

If, on the expiry of a period of three months from the date of referral to the Council, the Council has not acted, the proposed measures shall be adopted by the Commission, save where the Council has decided against the said measures by a simple majority.

***Article** 16*

In order to take into account the possible failure to take a decision on the detailed rules for applying this Directive by 1 January 1993, necessary transitional measures may be adopted in accordance with the procedure laid down in Article 15 for a period of two years.

***Article** 17*

The provisions of this Directive shall be re-examined before 1 January 1998 by the Council, acting on proposals from the Commission, on the basis of experience gained.

***Article** 18*

The Member States shall bring into force the laws, regulations and administrative provisions necessary to comply with this Directive before 1 January 1993. They shall notify the

(2) OJ No L 255, 18. 10. 1968, p. 23.

Commission thereof.

When Member States adopt these measures, they shall contain a reference to this Directive or shall be accompanied by such reference on the occasion of their official publication. The methods of making such a reference shall be laid down by the Member States.

Article 19

This Directive is addressed to the Member states.

Done at Brussels, 22 July 1991.

For the Council
The President
P. DANKERT

QUALITY AT GENERAL MILLS RESTAURANTS

Robert Joseph
Red Lobster, Orlando, Florida

General Mills Restaurants Inc. is a division of General Mills. General Mills is the "Company of Champions." Each division operates under the company goal statement, "To be the nation's best food company in terms of product quality and shareholder value."

Consumer Foods makes up 67 percent of company sales and earnings. Most of the major brands are common household items that you and your family use all the time.

The restaurant group makes up the other 33 percent of sales and earnings. The Red Lobster name is General Mills' largest brand.

With sales of over $1.5 billion this year, Red Lobster will serve over 150 million guests. Red Lobster is the largest dinnerhouse chain in the world. The second largest is Olive Garden, with sales of over $900 million. The newest concept is China Coast Restaurant, with five units and ambitious goals to be as large as its sister companies. Asian food is the fastest growing segment of dining occasions in the U.S. By the year 2000, three out of the twenty-one meals you eat each week will be Asian.

Projected growth for all three chains is for over 50 units per concept in the next few years. General Mills believes that restaurants will be a critical part of its projected growth plans. By the year 2000, the goal is to have over 2000 restaurants worldwide.

The restaurant industry is very competitive. Currently, there is over 55 percent overcapacity in seating. The hardest hit segment is fine dining, but all segments are having trouble maintaining their market share and traffic.

General Mills restaurants will use over 85 million pounds of frozen seafood this year. Forty-two percent will be shrimp products, 18 percent crab products, 17 percent fish fillets, 10 percent lobster, and 13 percent other shellfish and seafood products. We will also serve over 5 million pounds of fresh fish and 1.5 million pounds of live lobster. By the year 2000, our seafood needs will double to over 170 million pounds.

Not only are our seafood needs growing, but so are the needs of most dining segments. There has been a 4 percent increase in the number of restaurants serving seafood. This shows that America still prefers to eat seafood away from home. But even as U.S. consumption has turned down, so has consumption at restaurants. However, restaurants are using seafood to offer healthy alternatives to their guests. The American pallet has changed in recent years. Variety sells, and people are more willing to experiment with different types of foods when dining out.

The history of the departments of Purchasing and Quality Control started at the same time. The founders of the company realized back in the early 1970s that the limiting factor to growing Red Lobster into a national chain the size it is today would be the supply of high-quality, value-priced seafood. The founders believed that these two traits, plus great service in a clean, efficient restaurant, would be the key to success.

In the early seventies we were buying through brokers and distributors. The quality of the products varied greatly. Supply was inconsistent and prices were unpredictable. So the decision was made to create a purchasing department. Today the purchasing department travels to over 40 countries a year. Our buyers spend over 50 percent of their time at the producing areas and production facilities where our products are harvested and packaged. Buyers spend time training in their products so that they can travel anywhere in the world and teach fishers, production workers, and plant quality control personnel how to produce Red Lobster quality. Over 70 percent of our seafood comes from overseas. One hundred percent of our shrimp now comes from aquaculture. No matter where the resource is, our buyers are willing to go and learn about what this area of the world can offer our guests. We continue to use some brokers and importers who understand our needs and philosophy of quality, value, and service.

Marketing supplies Purchasing with changing trends in dining patterns and guest expectations. Purchasing plays a large role in developing new products and species and introducing value added products to save on back of the house labor. Today every item is made at each restaurant daily to ensure that our food is fresh and that our guests receive only the

highest quality seafood they can buy. It is a constantly changing environment, and what was good enough yesterday will not meet the needs or standards of today. By having an internal purchasing and quality control function, it has been easier to communicate needed changes to industry so that we can maintain our competitive edge.

By having the buying team visit the world's seafood-producing areas, we have been able to anticipate shortages, embargoes, and foreign competition that can drive price. Our menu and promotions are flexible, so we can work together with marketing to smooth out supply or price problems. Years ago when McDonalds put Pandalus shrimp on the menu and prices reached over $5.00 a pound, we were forced to reduce our usage from 3 million pounds to about 100,000 pounds. Now that the price has returned to a more stable level, our usage has increased to about 750,000 pounds. But it never gained its place completely back because the product we substituted continues to occupy that space and popularity. This year we substituted Dungeness crab for Opilio when supply and price became issues. On every trip we look for new ideas, products, or items. People forget that it was Red Lobster that introduced America to snow crab, popcorn shrimp, and orange roughy. This conference is an example of taking the opportunity to talk to industry about our company and to explore with this industry mutual areas of interest and potential business.

All our specifications are developed by our Purchasing Department with advice from industry. Before they are written up, Restaurant Operations and Test Kitchen approve them to make sure that our restaurants are receiving the correct product, properly packaged, and with maximum ease of use.

Once a specification is developed, products are shipped to one of our primary freezer locations (Atlanta, Los Angeles; Indianapolis; Trenton, Ontario). At each of these facilities, we have built quality control labs to inspect every shipment of seafood and other products. These labs are set up to evaluate packaging and physical characteristics and to check microlevels. No product ever is sent to one of our restaurants before it is inspected. Counts and weights are checked to ensure we pay for what we ordered and they meet our specifications.

Specifications address chemical additives, acceptable species, receiving temperatures, and other defects that could be seen with each individual product. Most of our specifications are stricter and more detailed than current government standards. They have been developed with industry so that what we inspect for is what industry can produce and package. We own our own shrimp processing plant, which enables us to understand that side of the business and teaches us what we should expect from other processing facilities. Our specifications are available for anyone to use.

During the late 1980s there were a number of seafood scares and bad publicity. To head off the issue that seafood was not government inspected, we worked with the U.S. Department of Commerce to have our inspection program certified. Our Integrated Lot Inspection Program has been very successful in that it is one more step to ensure that our guests receive only the best seafood. Red Lobster was one of the first companies to institute this program on a national level.

Training and continuing education programs are a key step to ensuring that the quality message is understood through all levels of the organization. Publications such as *Lobster Tales* and *Expert's Guide To Seafood* are used to train our employees and keep them current on all changes. Brochures in our restaurants' lobbies educate our guests to our quality programs, the health advantages of seafood, and nutritional levels of all our products.

All these programs together ensure that we deliver our goal: to provide a continuous supply of top quality seafood for our guests.

This translates into a pleasurable, safe, and confident dining experience for our guests every time they dine with us. If we do a poor job one percent of the time, over 1.5 million guests will have a bad experience. That is why we have always joined forces with industry and government to work together to create the best seafood dining experience for our guests.

It takes a complete understanding of all these areas to produce the quality story. for without a commitment to quality by all segments of our industry, consumers will find other ways to spend their food dollars.

THE NEED FOR DEVELOPING UNIFORM SURIMI STANDARDS

Jae Park and Michael T. Morrissey
Oregon State University Seafood Laboratory

INTRODUCTION

Surimi is washed, minced, fish flesh to which cryoprotectants have been added to maintain the functional properties of the proteins during frozen storage. More than any other seafood, it is relatively homogeneous in composition and physical attributes. Although there are a number of processing techniques, the end product (if made from the same species) will have similar characteristics whether it is made aboard a factory trawler or a shore-based surimi plant.

Japan has been the recognized leader in the global surimi industry. Surimi processing grew from a small traditional fisheries in Japan to large-scale operations during the 1950s. The initial phases of the industry depended on shore-based operations (Okada 1992). In 1965, the use of cryoprotectants allowed the production of surimi at sea, which greatly expanded the resource base for Japan (Zenkama 1987). The Americanization of the Alaska pollock fishery that began in the 1980s and was followed by the Pacific whiting fishery in the 1990s forced Japan to be more dependent on foreign harvests for their surimi Nonetheless, Japan has dominated the world's surimi processing technology for on-shore and at-sea operations. The total production of surimi in the world has fluctuated between 390,000 to 530,000 metric tons over the last five years (Kano 1992).

More than 100 types of surimi-based seafood products currently are produced in Japan. In the United States the majority of the surimi is processed into shellfish analogs, primarily imitation crab. The nature of the final product is such that gel strength and color are the most important attributes of surimi. Although a number of analog products are made in Japan and other Asian countries, gel strength and color continue to be critical characteristics of surimi sold overseas.

Surimi is one of the few seafood commodities that will receive a price differential based on a grading system. Understanding and manipulating the production to take advantage of this grading system is crucial in the marketing of surimi. For example, if company X makes three different grades of surimi - A, B, and C- for which there is a 10 percent price differential, it may be to the company's advantage to produce the higher-grade surimi, depending on the market conditions. However, if the cost of making the higher-grade surimi (lower yields, added production costs) are such that the price differential is negated, it may be more economically beneficial to make grade B surimi. In either case, knowing how the grading system operates and how different factors can affect grading of surimi samples can mean substantial increases to profit margins.

Factors Affecting the Grading System

The grading system for surimi is based on a number of its characteristics, some more important than others. These include

- Gel strength
- Color
- Moisture content
- Impurities
- Microbiological count

Other properties of surimi that can influence the final grade are pH, protein content, fat content, cryoprotectants, and other ingredients such as protease inhibitors, gel enhancers, and whiteners. A number of factors will have an effect on these surimi characteristics and are taken into account during surimi production.

Gel strength depends on the functionality of the myofibrillar protein and its ability to form heat-set gels (Matsumoto 1979). The gel strength is affected by the species of fish, seasonality, and time and temperature factors during handling onboard the vessel as well as during the processing steps. Compositional factors will also affect the gel strength readings. Lower moisture content will improve gel strength as well as starches and gel enhancers (Hamann and MacDonald 1992; Lee 1986).

Color largely depends on the species of fish that are used for surimi products. The typical low-fat white fish species such as Alaska pollock and whiting will give a color that is slightly off-white but will turn a creamy white

during analog processing. Pelagic species such as sardine or mackerel will have a more grayish hue, while other species will take on the inherent color of the flesh. The degree of washing will greatly affect the final color as well. The washing away of pigments or impurities will generally lighten the color of the surimi.

As mentioned previously, the moisture content will affect gel strength: the lower the moisture, the higher the gel strength. However, a lower moisture content in surimi results in lower yields and decreased profit margins. Since analog manufacturers add water to their formulations, they prefer the moisture to be lower than 75 percent. This is within the manufacturing tolerances of present surimi producers.

Impurities are normal bits of skin or viscera that have not been washed out during processing. They have little affect on the gel strength of the surimi but do affect consumer acceptance of the product, especially, if the final product is a creamy white analog. Some species have a certain percentage of "black spotting" in the flesh. If these fish are not culled, they can cause a defect that appears like "pepper on snow" and will cause a reduction in the grade (Morrissey et al. 1992).

Microbiological levels of surimi are important for quality control and health standards. Standards may include total plate count and coliform count as well as specific pathogens such as *Listeria*. The initial bacterial load on the fish is the most important factor for final bacterial count of the surimi (Lee 1992). Researchers have found that the washing steps did not appreciably reduce the microbial count (Himelbloom et al. 1991). With the increasing use of HACCP in the surimi industry, there will be increasing reliance on good microbiological controls in the plant.

The pH of the final surimi can greatly affect its gel strength and should be monitored during processing (Chung et al. 1993). Other additives, such as calcium compounds, can affect gel strength while glycerides and hydrogenated vegetable oil will have an effect on color or the sheen of the final block. Protease inhibitors, such as beef plasma protein, used in Pacific whiting surimi, markedly improve gel strength but may cause an increase in yellow color if used in too great. a concentration.

Surimi Characteristics: Measurements and Additives

Uniform surimi standards require a uniform methodology for testing surimi characteristics. Unfortunately, at present, this is not the case for surimi. There are a number of different instruments as well as methods for evaluating characteristics such as **gel** strength, color, and moisture. While the principles for measuring these characteristics may be similar among the instruments, there are a number of differences as well.

The measurement of gel strength is one of the more problematic. The traditional surimi method is the fold test by which a 3-mm-thick slice of surimi is folded several times and inspected for cracks resulting from the folding (Lee 1984). This procedure, although simple to use, can have a wide variation and is not very discriminatory among surimi samples with a high gel strength. Because of the subjective nature of the evaluation, it is difficult to standardize this type of test.

The punch test is currently the method of choice among surimi producers to measure gel strength. Recently, an electronic rheometer (Rheo Tex) has been commonly used to determine gel strength (NFI 1991). In this method, a plunger is driven at a constant speed into a surimi gel, and values are reported by measurements of force (force needed to penetrate the gel) and depth (the distance the plunger travels inside the gel). Gel strength (jelly strength) is expressed as the force (g) x depth (cm). While this method is more objective than the fold test, it still can give highly variable results that could lead to discrepancies between buyer and seller. Furthermore, there is no method to calibrate the instrument after extended use. Nonetheless, even with these shortcomings, the punch test is preferred because of its ease of use during at-sea processing.

A more accurate test of overall gel strength is the torsion test developed at North Carolina State University (Hamann and Lanier 1987). This procedure requires a standardized method of preparing the gel for testing such as bringing the moisture content of samples to 78 percent. The torsion test involves the twisting of an hourglass-shaped gel to failure. The resistance to the twisting is related to gel strength and is reported as stress while the degree of twisting that occurs before breaking is related to the elasticity of the gel and is reported as strain. The disadvantages of the instrument are that the accuracy of the results can depend on the technical expertise of the lab technician and that the instrument would be impractical on an at-sea factory trawler rolling in the Bering Sea.

Other researchers have used the compression test (most commonly performed with the Instron) as well as other instruments for analyzing texture. While these are good research tools, they are usually impractical for the typical surimi producer. The making of the cooked surimi gel to be measured is as much an art as a science. There are a number of factors, such as the type of sausage stuffer, and the use of a vacuum chopper, that will influence the results of the gel test (Babbitt and Reppond 1988).

The surimi paste is often prepared for testing by various methods that can lead to differences in the results. The surimi industry has been using three different formulas to prepare the surimi paste. One method uses 97 percent surimi and 3 percent salt, while another method uses 100 parts of surimi and 3 parts of salt. A third method uses 94 percent surimi, 3 percent salt, and 3 percent potato starch. There are only minor differences in the first two methods, but by adding starch to measure surimi gel strength (third method), we are likely to observe increased gel-strength values due to starch gelatinization. Park (1993) found that the addition of starch up to a 6 percent level raised the gel strength by 15 to 45 percent, depending on its kind and modification. An addition of 3 percent potato starch in the surimi gel will upgrade the gel-strength of the surimi.

The surimi industry currently uses three different cooking methods for testing surimi gels. They are (a) a 90 C cook for 30-40 minutes, (b) 24-40 C preincubation for 2-6 hours followed by a 90 C cook for 30-40 minutes, and (c) a 5 C preincubation for 18-24 hours followed by a 90 C for 30-40 minutes. Preincubation is called *suwari* in Japanese. This technique is used in the industry to facilitate molding and forming products for kamaboko or crab analogs. The effects of preincubation have been studied by a number of investigators (Numakura et al. 1985; Kim 1987; Kamath 1990; Park et al. 1993). There is a minimum effect on gel elasticity, but preincubation can affect the gel stress (strength) by 15-60 percent, depending on the method and fish species. Because of these effects on gel strength, there is some confusion between buyers and sellers in surimi evaluation.

Surimi additives used in commercial processing are another important issue that we need to look at for the standardization of surimi. Cryoprotectants have been used in the processing of surimi since Japanese scientists found the combination of sugar and phosphates can extend the shelf life by inhibiting freeze-induced protein denaturation (Okada 1992). Different levels of sugar (4-5 percent), sorbitol(4-8 percent), phosphates (0.25-0.3 percent), and more recently glyceride (0.1-0.2 percent) for whiting surimi have been used by manufacturers. Manufacturers believe their recipe is specially blended with a patentable propriety.

With the processing of Pacific whiting for the last three years on the Pacific coast, the use of enzyme inhibitors is necessary to make quality surimi. In 1991-1992, several enzyme inhibitors such as beef plasma protein, egg white, and potato flour were evaluated by manufacturers and research institutes. In 1993, all manufacturers of Pacific whiting surimi used beef plasma protein (1.0-1.5 percent) as an enzyme inhibitor. With continuing efforts to make whiting surimi comparable to pollock surimi, calcium carriers (such as calcium lactate, calcium sulfate, and calcium caseinate), sodium bicarbonate, and canola oil have been used as a gel enhancer or a color-improving agent. Again, all manufacturers use different levels as well as different combinations in the name of proprietary blending.

There are some problems with the grades and specifications of surimi from the view point of consumers and analog manufacturers. First, each manufacturing company has its own specification of grades and additives. Second, there are no uniform grades among companies. Third, there is no uniformity in compositional properties, because of the addition of different levels and kinds of additives. Fourth, there is not a universally accepted testing methodology. In 1991, the Technical Committee of Surimi and Surimi Seafoods through the National Fisheries Institute established the U.S. standard of surimi measurements (NFI 1991). However, none of the surimi manufacturers have shown their willingness to adopt it.

Current Practices in Surimi Industry

Technical systems for surimi processing have been developed by the five most important fisheries in Japan (Taiyo, Nisui, Hoko, Nichiro, and Kyokuyo) based upon their own interest and business involvement. These technical systems have been further modified by Korea and the United States, again because of their own interests.

To demonstrate the different grades, we have selected 11 major surimi manufacturers of Pacific whiting surimi (table 1). The grading systems vary from company to company, and

there are even differences between two factory trawlers within the same company (I-l and I-2). The eleven companies use very similar grades and specifications for Alaska pollock. The only grade they all agree on is the SA grade for their best surimi. Most of the companies use the FA terminology for their second best grades. Four different grades are available for their third best category. Five different grade names are offered for the low-grade surimi. Interestingly, company K offers only two grades, SA and FA.

<2 mm, while other companies give 1 point for lengths >2 mm, l/2 point for l-2 mm, and 0 points for <l mm. There are two systems used in the industry for determining the impurity of surimi. The most common method is to use defect counts, while the other method uses a 1 to 10 scale purity point such as company B. The numbers shown in table 2 are extremely different among companies because of the sample size and the counting method.

As previously mentioned, gel strength is one of the most important factors in surimi quality

Company	(High) ——— Grade ——— (Low)					
A	SA	FA	AA	KA	RA	RB
B	SA	FA	A	KA		
C	SA	FA	A	KA		
D	SA	FA	P	K	B	
E	SA	FA	P	K	B	
F	SA	FA	AA	RA		
G	SA	FA	A	B		
H	SA	FA	A	KA	B	
I-1	SA	A	KA	B	KB	
I-2	SA	FA	A	KA	KB	
J	SA	FA	AA	A	RA	

Table 1. Grades of commercial Pacific whiting surimi.

Specifications of each quality parameter have been used as guidelines for grading. Five major companies were selected to compare the differences in their specifications. The moisture level in surimi is important and is related to whether or not the surimi-based seafood manufacturers are buying water or fish protein. There is about a 1 percent difference among companies for the top two grades. Most of the companies set the same specifications for all grades; company A and company D are exceptions. Four different heating elements may be used to determine moisture. They are infrared, microwave heat/auto scale, electric heat/auto scale, and oven methods. The first three can give relatively good results within 10 to 15 minutes, whereas the oven method needs 16 to 20 hours. However, the oven method gives the most accurate results.

For the measurement of skin bits or defects, all manufacturers follow the guidelines of the Japanese Surimi Association with various degrees of modification. Sample size may vary, being either 10 or 40 grams. The counting scale may also vary when counting skin bits or defects. Some companies assign 1 point to lengths >2 mm and 1/3 of a point for lengths

measurements. However, there is a large difference among the companies. Gel strength (gm-cm) is calculated based on the force (gm) required to break or tear the gel and on deformation (cm), which indicates the degree of the gel's resistance to a penetration probe. Most of the companies use the gel strength as a force value multiplied by deformation, while company H uses a force value only. The range among the companies is between 850 and 1000 for the SA grade and between 900 and 750 for FA grade. These differences may be due to the type of gel preparation and whether starch is used when making the sample gels. Preincubating of the surimi will also affect the final gel strength measurements (Kamath 1990). The greatest difference between the different companies is in the lower grade surimi (AA and KA), where there is a 200-unit difference.

Color specifications for surimi are extremely different among the companies, as shown in table 2. The surimi industry has been using three different brands of colorimeters: Minolta, HunterLab, and Nippon Denshoku Kogyo. Even though the principle of color measurement is identical, there is still a small but significant difference between the machines.

Table 2. Specifications of commercial Pacific whiting surimi. Companies A, B, D, and H are selected from table 1.

1 Moisture (± 0.3%)

A		B		D		G		H	
SA	74.5	SA	74.1	SA	73.5	SA	74.3	SA	74.5
FA	74.5	FA	74.1	FA	73.5	FA	74.3	FA	74.5
AA	74.5	A	74.1	P	74	A	74.3	A	74.5
KA	74.5	KA	74.1	K	74.5	B	74.3	KA	74.5
RA	77			B	75			B	74.5
RB	77								

2,Skin and Defect Counts *PurityScore

A		B*		D		G		H	
SA	15	SA	9	SA	10	SA	8	SA	15
FA	20	FA	8	FA	10	FA	14	FA	20
AA	20	A	7	P	10	A	14	A	25
KA	20	KA	7	K	25	B	23	KA	80
RA	15			B	35			B	80
RB	30								

3, Gel Strength(gram.cm) d*Force(Gram)Only

A		B		D		G		H*	
SA	1000	SA	900	SA	1000	SA	900	SA	850
FA	900	FA	750	FA	900	FA	750	FA	700
AA	800	A	600	P	750	A	600	A	600
KA	700	KA	450	K	500	B	450	KA	400
RA	300			B	300			B	<400
RB	<30C								

4,Color (L*/b*) *Nippon Denshoku Kogyo based on Whiteness Index

A*		B		D		G		H*	
SA	47	SA	7614.5	SA	74/12	SA	75/4.5	SA	46
FA	46	FA	75/5.0	FA	73/14	FA	75/5.0	FA	45
AA	45	A	74/5.5	P	72/15	A	74/5..5	A	44
KA	44	KA	72/8.5	K	71/l 5	B	74/8.5	KA	38
RA	38			B	70/17			B	<38
RB	<38								

Companies A and H use a whiteness index based on an equation using X, Y, Z values; the other three use L* (lightness) and b* (yellowness). When L* and b* values are compared between companies (B, D) using the same equipment, a significant difference is observed, as shown on table 2.

Reasons for Establishing Surimi Standards

The setting of surimi grades has been a process that has evolved with each company over the years. In the past, when surimi was a small land-based industry concentrated in Japan, the traditional fold test was adequate to determine the gelling characteristics of the product made from the landed catch. As the industry has become more global and the production has grown to approximately 1 billion pounds per year of product being produced from at-sea factory trawlers and shore-based plants, these traditional methods are inadequate to define the product. There are, no doubt, advantages to individual companies in having their own grading system. If they are large producers, they can have a tighter control of their product and thus their markets. Ideally, they could have a complete understanding of their own surimi measurements and know how these measurements relate to harvest variables, yield, and protein content. They can lock in customers using their grading system and make it difficult for a customer to change to other brands.

However, the setting of different grading systems and values within the industry leads to high information costs. It becomes more difficult for a surimi-based seafood producer to change suppliers and fully know the characteristics of the surimi. How does a different grading system affect his formulation and final product quality? If there are differences, how does this affect consumer satisfaction? Does an FA grade of 900 gel strength from company A translate to the same protein quality of an FA grade of 750 gel strength for company B, if company A is using starch in its gel measurements?

These differences in measurements and grading can cause confusion in the marketing of surimi. Larkin (1993) states that different "firm-specific grades are not an efficient mechanism for conveying the key surimi characteristics for the following reasons:

1) Surimi is not an homogeneous product despite its appearance, i.e., laboratory tests are needed to determine levels of key characteristics;
2) External processors face unnecessarily high costs of gathering information about alternative supplier grades, i.e., search costs exist;
3) External processors may develop a dependency on a past supplier, i.e., buyer loyalty exists that may ensure product consistency while allowing suppliers to restrict substitution possibilities and monitor their potential rivals in the final surimi-based seafood market."

Standards for any raw material help to define that commodity and promote fair trade practices. It is as important for buyers to know exactly what they are receiving as it is for sellers to receive a fair price for their product. Standards are beneficial to the industry as a whole and will encourage growth and promote stable markets. At present, the United States is the largest producer of surimi and Japan is the largest user. Any development of a surimi standard requires agreement between these two countries. A unilateral agreement by either one of the countries could cause greater confusion and mistrust in the surimi industry and uncertainty in world markets. Both countries need to fully agree on the standards and grading system.

A standard grading system requires the standardization of methodology and instrumentation. Preparation of samples, reagents, and calibration of instruments need to be accurately defined and followed. A start in the right direction has been the publication of the manual for measuring surimi quality by the National Fisheries Institute (NFI 1991). Although the manual does not establish a system of grades, it explains which compositional properties are important for measuring surimi quality and describes the methodology for measuring these properties. These standardized methods are suggested for in-house measurements to ensure quality control and accurate product formulation. Accurate measurements for surimi depends, in part, on whether a simple methodology can be followed by technicians at shore-based plants, on factory ships at sea, and in various counties. Cooking times, sample size, and ingredients for forming the test sample are important considerations. The salt concentration and moisture percentage are important variables that need to be held constant for a standardized testing regime. As noted previously, several companies add

starch. Since starch is an added variable in the testing and can exhibit its own gel-forming properties, it should be eliminated from the testing methods. These are some of the issues that should be decided by a standardization committee.

The standardization of testing equipment is also a necessary component of determining standards for surimi. The most commonly used methods for measuring gel strength are the punch test and the torsion method. There are limitations in correlating the punch test with the torsion test in surimi (NFI 1991). These correlations are weak for measuring the elasticity of the gels or for lower grade surimi. This could be especially true for some of the new species of fish that are being introduced into the surimi marketplace. It will be beneficial to the industry as a whole if only one type of instrument is used and the methodology is well described. This would require an accurate way to calibrate the instruments so that they would measure the same functions throughout the season. This should be true for the color measurement as well. The establishing of a color standard (or hitching tile) is necessary to accurately calibrate the instruments before taking color measurements.

CONCLUSIONS

The surimi industry has evolved rapidly over the last half century. It has changed from a small, traditional, shore-based industry in Japan to a billion dollar industry involving a number of countries and increasingly a number of species of fish. The grading system has evolved as well from a subjective analysis of texture and color to a more sophisticated objective system of analysis of gel strength, L value, moisture, and so on. Although there are several discrepancies in how these quality parameters are currently measured, there is a common goal for most companies to have a systematic way to evaluate surimi blocks. There are differences, at present, in the grading of the surimi. However, there are also a number of similarities, and the numbers almost beg for a committee to establish a standard grading system for measuring surimi. Any committee formed to establish standards and grades needs to include representatives from the Japanese and the U.S. surimi industry. The surimi industry should support the establishment of grading standards to help stabilize the industry, A uniform grading system would improve the efficiency of the industry and increase competitiveness across all sectors. Reduced costs related to information gathering could be translated to decreased costs in final product form and to the consumer. This will allow surimi to be cost competitive against other seafood and nonseafood items and expand its marketing opportunities.

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IMPLEMENTING AN ISO 9000 QUALITY SYSTEM IN A EUROPEAN SEAFOOD COMPANY OPERATING INTERNATIONALLY

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INTRODUCTION

In this paper I will discuss the various aspects of systematic quality management as presented in the ISO standards. Where appropriate, I will try to refer to my personal experience working with an ISO 9001-certified quality system. The focus of my discussion will be the following points.

- What is meant by the terms ***quality*** and ***quality assurance?***
- What are the typical components of an ISO 9000 quality system?
- Why should a seafood company choose to work with a structured quality system?
- What are the benefits?
- How long does it take to integrate this kind of a system into an organization and how much might it cost?

I will discuss the general principles involved and use some practical examples that relate to the seafood industry.

QUALITY TERMS DEFINED

The international business world seems to be deeply concerned about quality. This concern may be only a new fad or the hope of salvation for every businessman and industry. My personal experience is that nobody with any sincerity can afford to look at this only as a fashionable idea. To compete successfully on the global food market, an industry like the seafood industry needs to take quality management very seriously. This recent interest in quality seems to arise mainly from the fact that the Western world has come to understand that the basis of Japan's industrial success in the last few decades is quality. Now we are all extremely busy trying to come to terms with this. Everybody wants to be saved by quality or at least use it somehow to achieve a competitive edge in the future.

The next logical question becomes, what is quality? The term has many meanings, depending on culture and type of industry. It is important to define quality before going any further. Many have said (Juran 1989; Surak and McAnelly 1992) that ***quality is the economical production of consistent products and services that meet or exceed customer requirements.*** We can add to this statement, ***and conformance to regulations.*** Furthermore, it is obvious that customer requirements are more than just meeting specifications.

To meet customer requirements, we need information from market research that lets us understand customers' needs and problems. Then we need to develop a process for producing goods and services that meet or exceed customer's needs or desires. Finally, we need to sell the products or services at appropriate prices. When any of these criteria can't be met, it is obvious that the product or services have not met the definition for quality. For example, rework, waste, or loss during production or distribution of seafood product means there is a decrease in quality. This is because the customer eventually will have to pay more for the product or the owners of the company will receive less return from their investment. To illustrate further the true meaning of quality, we can compare two automobiles. A Rolls-Royce, which meets the specifications for a Rolls-Royce, is a quality car. But it is equally true that a Russian-built Lada, which meets the specifications for a Lada, is a quality car. Quality is meeting the requirements.

Another term one comes across frequently (Surak and McAnelly 1992) is ***quality assurance,*** which is the planned and systematic actions necessary to provide adequate confidence that processes, products, and services satisfy the requirements of quality. This definition brings us back to the ISO 9000 standards since they are probably the best tool available to any industry for setting up a system to manage quality and maintain quality assurance.

ISO 9000 QUALITY SYSTEM COMPONENTS

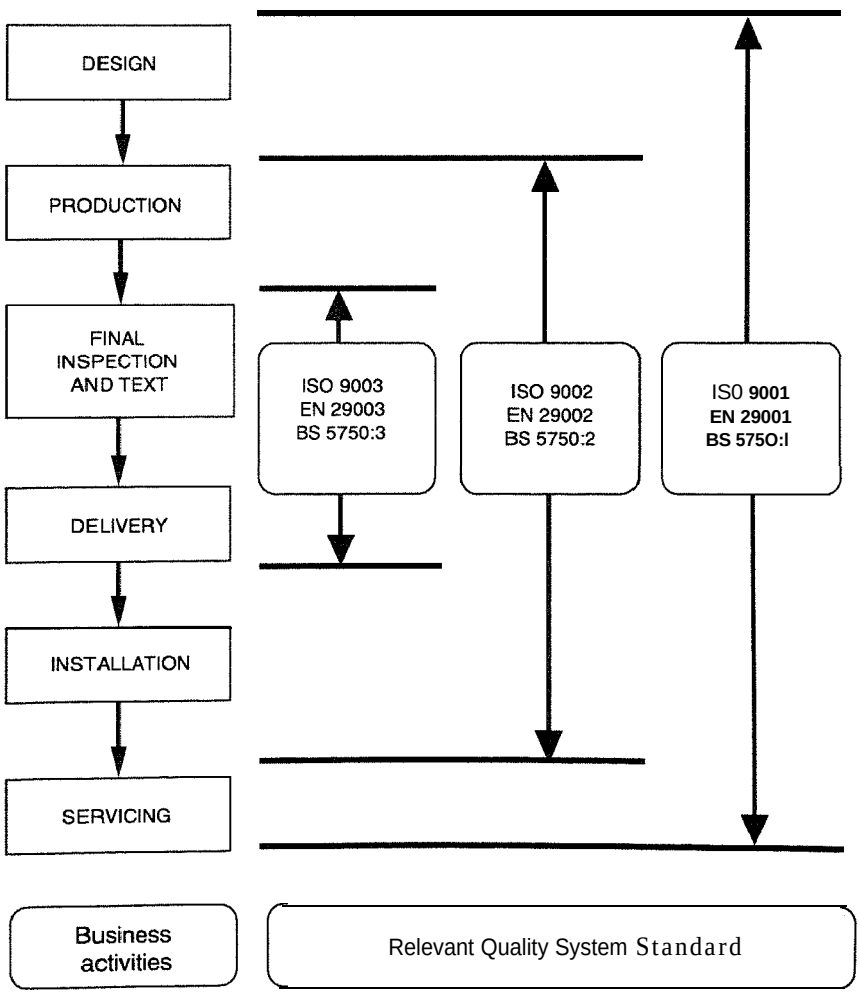
The following standards (published in 1987) are used as guidelines for quality management systems:

- IS0 9000 - quality management and quality assurance standards-guidelines for selection and use
- IS0 9001-model for quality assurance in design/development, production, installation, and servicing
- IS0 9002-model for quality assurance in production and installation
- IS0 9003-model for quality assurance in final inspection and testing
- IS0 9004-quality management and quality system elements-guidelines

For practical purposes most quality systems that I know about are based on either ISO 9001 or 9002. Figure 1 shows the elemental difference between the models. IS0 9001 is the most comprehensive one, and IS0 9003 is the simplest, as it deals only with final inspection and testing. To add to the confusion, the standards have different reference names in Britain and in the EEC. In the UK, 575O:part 1 is the same as EN 29001 in the EEC; both are identical to what internationally is called IS0 9001 (BSI Quality Insurance publication). Gudmundsson (1992) points out some of the key reasons for using the IS0 standards: to provide direction, generate ideas for change, design or redesign systems, implement changes, measure results, and manage change through audits and reviews.

The IFPC *Quality Assurance Manual* describes a typical ISO 9001 quality system. Figure 2 lists the contents of the manual. Each of the 20 chapters in the manual deals with specific activities.

Many people think of quality in the limited sense of product quality and quality control. However, the standards address all the usual activities taking place in an organization. In the food industry one can easily visualize many



Source: Pira International

Figure 1. The scope of the three quality system standards.

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Figure 2. Contents page of IFPC' s Quality Assurance Manual.

of these activities also being addressed with a HACCP-based system. The main difference between the two systems is that HACCP concentrates on process control and is one of the best tools available for this. ISO 9000 systems, on the other hand, ensure the overall management of quality in all quality-sensitive aspects of the organization.

The company I work for, Icelandic Freezing Plants Corporation, has a long history of using the term ***quality*** as a key part of its market approach. The corporation celebrated its 50th anniversary last year, and in March 1992 became certified towards ISO 9001. Commitment to this work was made in the spring of 1991, and I was given the task of compiling the quality assurance manual and quality procedures in cooperation with other IFPC staff and consultants from a British company with extensive experience in this field. It took us at IFPC about eight months to have the system written, implement it, do a number of internal audits, amend procedures, introduce some changes to work routines, and finally pass the assessment of BSI quality assurance (Bogason 1992).

The reason this was possible in such a short time was that there was total commitment and leadership from the top management of the company. Also almost all the personnel participated in some aspect of the work.

There is no mystique involved in this process. Basically what you need is to start organizing and documenting in a formal manner the actual work being carried out within the company. The only new aspect in the process is using the ISO 9000 standard to guide you in setting up the controls required by the individual ISO standard you choose as the model for your quality system. The result is a formally written quality assurance manual and quality procedures that describe your company's tradition for doing the daily tasks while adding the security of controls in specific areas of work, many of which may be new to the company. The individual chapters in the typical quality assurance manual specify how the company operates and ensures that the requirements of the ISO 9000 standard are met. The quality procedures describe in more detail how they are met.

The IFPC quality management system documentation could be viewed as a pyramid (figure 3). At the top we place the quality policy. In the next layers are the quality assurance manual, quality procedures, and work instructions. The foundation of the documentation is the records that prove we do what we say we will do. The description of the work routines is increasingly detailed toward the base of the pyramid.

Examples of new tasks that most companies would have to deal with are controlling the formal documents, assessing the supplier, and conducting internal quality audits. Figure 4 shows a form that was introduced at IFPC to deal in part with the requirement of the ISO 9001 standard: "*Part 4.6.2 Assessment of sub-contractors - The supplier (company) shall select sub-contractors on the basis of their ability to meet sub-contract requirements, including quality requirements. The supplier (company) shall maintain records of acceptable sub-contractors.*" Figure 5 shows a sample outline of the quality procedure that corresponds to this part of the standard. Also, we maintain a list of approved suppliers for IFPC, and in many cases we visit the suppliers to perform quality assessments. The reason for taking this as an example from the standard is to point out the obvious. Certified companies will establish criteria for assessing their suppliers, and the main criterion will soon become that the supplier company also be certified. This will reduce the amount of inspection required for goods or services being purchased. Credibility and confidence will be greater for certified suppliers. All competent companies will gradually

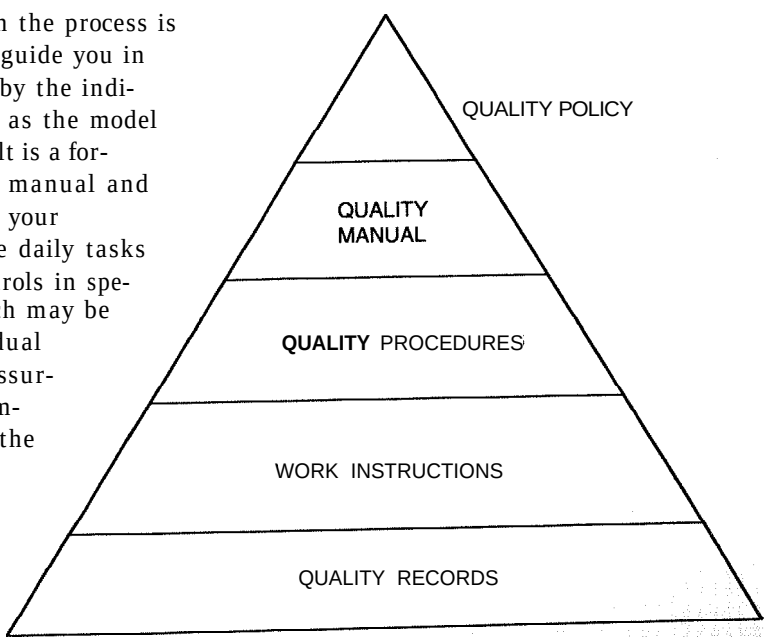

Figure 3. Structure of the IFPC quality management system.

SÖLUMIDSTÖÐ HRAÐFRYSTIHÚSANNA
ICELANDIC FREEZING PLANTS CORP.

VENDOR ASSESSMENT QUESTIONNA!RE

Supplier:

Address:

Phone: Fax:

Products and Services:
(Please list:)

Name and status of person responsible for Quality Assurance:

[Please supply a Quality assurance Organisation Chart]

Total number of employees:

Total number of QA personnel:

List of formal quality approvals:

What quality approvals do you intend to obtain:*

*[Example would be the ISO 9000 series standards]

Comments:

Signed: Position: Date:

EBL-065

Figure 4. Vendor assessment questionnaire.

QUALITY PROCEDURE

Page 1 of 1
Issue : 4
Approved by: Travis Q. Magnusson Date : 15/9 '92

ASSESSMENT OF SUPPLIERS

Objective
To ensure that suppliers Of goods and services used within the quality system areselected on the basis of their ability and that their performance is monitored.

Procedure

1. **Quality Manager**
Suppliers of goods and services are assessed and their performance is monitored in consultation with the Purchasing, Quality Control, Shipping, xxxxx xxxxx xxxxxx xxxxx xxxxxxxxxxx xxx xxxxxxxxxxxxxxxxx.

2. **Functional Managers**
Information about suppliers performance and complaints resulting from their services or goods are relayed to the Quality Manager. Complaint xxx xxxx xxxxxxxxxxxx xxxxxxxxx xxxxxx xxxxxx xxxxxxxx xxxxxxxxxx xx xxxx xxxxxxxxxx xxxxxxxxxxx xxx xxx xxxxxx xxx xxx xx . A. Manual.

3. **Quality Manager**
Wherever possible suppliers registered as firms of assessed capability to ISO 9000 or similar are selected. Other suppliers are selected using one or more of the following criteria:-

- Supplier questionnaire form
- Evaluation of sample products
- On site assessment
- Past history of performance.

xxxxxxxxx xxxxxx xxxxxxx xxx xxxxxxxxxxxx xxxxxxx xxxx xxxx xxxxxxxxx "Approved".

4. **Quality Manager**
xxxxx xxxx xx x xxxxxxxx xxxxx xxxxx xxxxxxx xxxxxxxxx xxx xxxxx xxxxx xx x x xxxxxx xxxxxx xxxxxxx xxxxx xxxxxx xxxx xxxx xxx xxxxx xxxx xxxxxxxx xxxx xxxxx xxxxxx xxxxx xxx are recorded and filed.

Figure 5. Sample outline of a quality procedure.

be pulled on this bandwagon, willing or not. Those who refuse to put their effort into quality issues will lose market shares, just as those who pull their weight with enthusiasm will gain the competitive edge. Remember that at some stage everybody is both a supplier and a customer. The same thing is true within a company as each department needs to be sure who its customers are and what their requirements are.

We found forms to be very useful in efficiently introducing the controls and record-keeping required. In many cases the staff complained about the forms, but that was before they realized that using forms didn't take any longer to relay information than scribbling the information or request on some piece of paper. Also everybody quickly saw that the security gained was immensely important as information was not being lost and actions became more accurate. The number of failures to act upon an internal request was reduced and the staff became more responsible for their actions. Doing it right the first time is extremely important in all organizations because it reduces the cost of redoing the work (Bogason 1992).

At IFPC a new computer system has been set up. In designing its routines, we made an effort to automatically log in as much as possible of the record-keeping information required by the quality system. Consequently, many of the forms introduced when the system was being implemented have now become superfluous. Always remember the kind of motivation needed for the people who have to carry out the routine tasks like working according to procedures and using forms. You have to show the staff why a routine is required and help them see for themselves the benefits coming from this approach. Training is a key element in the effort, and the standard stipulates general requirements for training. Each company has to specify how its training needs will be met.

WHAT ARE THE BENEFITS?

There are four reasons the ISO standards can be useful to **a** company. First, the standards are internationally recognized. Second, they help organize the internal operations in an organization; in other words they can make all work flow more easily and prevent mistakes from happening. The quality system should reduce the effort needed for internal inspection and double checking within the company.

Third, a company receives public benefits from ISO standards. A company that has a certified quality system can tell its customers it has been certified to the ISO standards. As customers are informed about the third-party assessment involved, the company and the quality it stands for gain credibility for the customers. European firms are under increasing pressure to become certified, and more frequently it is becoming a requirement for doing business. The fourth reason ISO standards can be useful is that the standards help establish proof of due diligence on part of the organization in maintaining the safety of processes, products, and services and in meeting legal requirements. ***Due diligence*** is the term used when a company has taken all possible steps and preventive measures to ensure the safety of its product.

APPROACH FOR SEAFOOD COMPANIES

How can a quality management system be beneficial specifically to seafood companies? There are no simple answers. Let's put it this way: if a company chooses not to manage quality in any formal manner, will it be competitive or be able to maintain the necessary credibility for customers, consumers, and regulatory bodies? My approach is as follows (Bogason 1992). By setting up a quality management system according to the ISO 9000 standards, any organization has then invested time, effort, and money to develop an immensely powerful tool for managing that organization. A carefully designed quality system is a general management tool for almost all operational activities. The finance department is usually excluded from the ISO 9000-based system. Although the standards do not require the financial department to be a part of the quality management system offered for certification, it can be organized and controlled by the same methods and philosophy.

How long will it take to become registered? If the company has a formal quality system-e.g., a HACCP system-in place, it could take only six months. However, this would be the exception; a company starting without a formal quality system should allow a year or two to become ready for assessment.

The ISO 9000 standards do not by themselves specify or demand any specific level of quality or service. Each company has to establish its own standards of excellence or its service level. The standards basically require only

that the company meet customer requirements, informing the customer about the product or service being offered. The standards also require that legal aspects be considered and regulations be met. How a company does these things is not specified; for a food company the requirements are most commonly met by setting down product, process, or service specifications. Typically, the cornerstones used by the seafood industry are finished product specifications, packaging specifications and process manuals containing procedures for hygiene control, and good manufacturing practices. These documents will be carefully controlled within an ISO 9000 quality management system. How, and what types of records are kept, is determined by the processes and the risks involved or the safety needed for the products or process involved. By maintaining a viable quality system, the company should not have difficulty proving that it is maintaining due diligence.

How much does it cost? The costs will vary from one company to another depending on the nature of the existing quality system. Holmes (1991) advises companies to budget a sum roughly equivalent to a middle manager's annual salary to cover the implementation costs. This, he says, will cover the time spent on the project by the management team in briefing, training, and external assistance. The chief executive officer needs to allocate 2 to 3 percent of his or her time to ensure that the project stays on track. The rest of the management team needs to allocate about 10 percent of their time to developing and introducing the system (Holmes 1991)

In Iceland the emphasis is now on applying HACCP to the production flow within the processing plants and designing them in the manner that makes them applicable as parts or elements of IS0 9000-based quality systems. Through the certification of its ISO 9001 quality system, IFPC has met many of the basic requirements for the individual quality systems being assimilated at the production level in its member plants. In other words, future quality systems will in many cases use the ISO 9000 approach for the overall quality system and will use HACCP techniques in the production to meet specific requirements.

To conclude, I would like to present a model (Bogason 1992) of a quality management system for a seafood processing company. The processor would use the ISO 9002 or 9001 standard as the guideline for the company's overall system. From that the processor would draw the management and organizational elements and then use the HACCP approach to set up process controls for the processing lines. In this context, processing would be defined as starting aboard the fishing vessels and extending through to the delivery of the finished products to the customer. Therefore quality system documents relating to chapters 8 and 9 and parts of chapter 12 in the standard would be more or less written with the HACCP approach in mind; they would analyze critical points and put in place necessary controls and record keeping. Then the company would use the total quality management (TQM) approach to set quality goals and improvement benchmarks for the company and personnel. Internal audits and TQM work would then ensure that the quality system is constantly being improved.

A simple but important statement is appropriate here: quality cannot be inspected into a product, service, or task. The correct quality can be achieved only by manufacturing the product, providing the service, or performing the task to the required standard. The quality issues would then be served in the progressive manner envisioned by the management, customers, consumers, and regulatory bodies. The certification, and the regular third-party assessment, is really only the first step in making quality the cutting edge for the future of any seafood company.

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ISO 9000--THE SEALORD EXPERIENCE (PAST LESSONS AND FUTURE VISIONS)

Robert deBeer
Sealord Products Ltd., Nelson, New Zealand

In December 1992 the Nelson site of Sealord Products Limited gained certification to ISO 9001. Although this was a significant achievement, one of which Sealord is proud, the company considered it the start of a process of continuous improvement and not the end of a self-contained project.

Two questions have been repeatedly asked of Sealord since it achieved this milestone: What would you do differently if you had to do it again? and What do you plan to do now that you have been certified?

In this paper I will answer both of these questions.

SEALORD PRODUCTS LIMITED

Sealord is the leading seafood company in Australasia. It employs 1400 people, has an annual turnover of NZ $350 million, and produces a range of retail and commodity products. The company has grown rapidly over the past decade, initially because of the success of orange roughy, then later because of the effort made to become a genuinely customer-focused company.

THE HISTORY OF QUALITY ASSURANCE AT SEALORD

Like most food companies, Sealord had elements of a quality system in place early in its development, but the first attempt to pull these elements together into a coherent body took place five years ago.

This initial effort was not a success, due in large part to the lack of a model on which to base the system, but it did leave behind it some elements of a quality system that could be used in the future.

In 1991 the drive to develop a quality system resurfaced. The impetus came from two sources. First, Sealord's marketing strategy had continued to move away from commodity trading and toward added-value, customer-specific products. This move placed greater and greater demands on production, logistics, product development, and marketing. Sealord recognized that it would benefit greatly from a more structured quality system, especially since things were hardly likely to get less complicated as the size of the company increased. Second, a number of key markets, particularly in Europe, seemed likely to impose a mandatory requirement for certification to an ISO 9000 standard.

The move toward customer-specific products meant that Sealord wanted to focus on developing a quality system that really worked. Furthermore, as a result of the pending mandatory requirements, the company set a time frame and committed its entire organization to a concerted effort to work within that frame. With the benefit of hindsight we see that this is one of the keys to setting up a quality system-momentum. It would be nice to fiddle around and build up a quality system without any stress or fuss, but in the real world such a quality system would be useless - it would be out of date before it was set up. It would also be anonymous; one of the real advantages of building a quality system at speed is that it raises the prominence of quality concepts within an organization and develops a momentum that will ensure the system continues to grow and evolve long after the arbitrary level of certification has been achieved.

To guide the certification process, a quality systems manager was appointed, and within 12 months Sealord had been certified to IS0 9001.

As simple as that?

Not quite. Sealord experienced a number of problems along the way, some due to the nature of the food industry, some due to the nature of the fishing industry, and some due to good old human nature. With the benefit of hindsight, some pitfalls are apparent.

SOME OF THE LESSONS LEARNED

Commitment

One of the most common gripes of a quality manager is that the company management are not committed to quality. In reality it is more likely that they are committed to quality per se but require expenditure to be justified by

something a little more substantial than "Juran and Deming say so." This is very much the case at Sealord.

Nick Grainger, at the New Zealand Organization for Quality Conference in 1992, pointed out that if, for some reason, the management of a company are not truly committed to quality, then it is the job of the designated quality practitioner to get them committed (Grainger 1992). There are plenty of convincing arguments and examples available to support the benefits of quality.

Commitment is "measured" in the IS0 9000 standards under the heading of "Management Review," where a company needs to measure its performance against its stated objectives. One of the external auditors of the Sealord quality system has observed that a telltale sign of a company that is not really committed to quality is an impressive sounding mission statement with no way of measuring progress against it.

Which Standard Should a Company Go For?

For any company that relies upon export markets, then the ISO 9000 series of standards stand out as a good choice. They have been adopted as a national standard by a large number of countries and despite some deficiencies, they serve as a reasonably sound model to use.

There are three standards in the ISO 9000 series: 9001, 9002, and 9003. There is a popular misconception in some countries that ISO 9002 is the most appropriate standard for a manufacturing company to go for. This standard covers the organization of the company, contract review, purchasing, process control, inspection and testing, control of nonconforming product, internal auditing, and training-everything it takes to make a product consistently. What ISO 9002 doesn t cover is the design and development of new products and processes and the after sale servicing of customers. ISO 9001 does cover these areas. To Sealord the decision was that simple - the effect of product and process design was too critical to the marketing strategy to be ignored in the quality system

It is surprising, then, that so many food companies choose to go for ISO 9002. Some even choose to go for ISO 9003 first as a starting point. The ISO standards were not designed to be used in this way. Each standard is a model for a company with a different requirement for its quality system (Standards Association 1990). In selecting a standard, it is surely the most logical approach to start off with the most comprehensive standard, ISO 9001, and go to ISO 9002 only if the sections on design control and servicing clearly do not apply. This advice has anecdotal support from Iceland, a country which seems to favor the ISO 9001 standard for its fishing industry (Scudder 1993).

Planning the Implementation

As mentioned earlier, it is tempting, when formalizing a quality system, to set vague objectives for certification. While companies taking this approach may still get there in the end, it is likely that they will take longer than necessary. A detailed plan will ensure that a level of momentum is established and maintained throughout the implementation process.

A simple technique for planning the implementation is the use of matrix diagrams, such as that shown in figure 1. This matrix will ensure that all elements of the standard are addressed in the documented quality system. For each procedure identified through the matrix, responsibilities, scopes, and target dates can be set. The time spent on this phase repays itself many-fold and this technique is being used in planning the certification for the rest of the Sealord group.

Selection of a Certification Body

The organization chosen to certify a quality system is going to be a partner of the company for a long time to come. Although Sealord selected KPMG-QCI as its certification body quite late in the play, Sealord realized that it would have been far more desirable to have developed a relationship with them earlier. The sooner a certification body is selected, the sooner specific requirements and interpretations can be dealt with.

Beware of Documentation

The ISO 9001 standard uses the word "documentation" a lot. Unfortunately, this is often interpreted as being synonymous with "written." It is not. Documentation can be in the form of photographs, physical standards, diagrams, computer screens, cartoons, videos, and practically any other way of reliably communicating information. The written word should be used only as a last resort, particularly in the seafood industry. Is it really worthwhile writing a detailed manual on fish handling techniques for fishers or a tome containing every conceivable way to trim a Hoki fillet?

9001	COMPANY PROCEDURE					
SECTION	PURCHASING	PLANNING	INDUCTION	INVOICING	STOCKTAKING	ETC.
4.1						
4.2						
4.3						
4.4						
4.5						
4.6						
4.7						
4.8						
4.9						
4.10						
4.11						
4.12						
4.13						
4.14						
4.15						
4.16						
4.17						
4.18						
4.19						
4.20						

NOTES/REFERENCES ON
"RESPONSIBILITY,"
'TIME FRAME,"
AND "SCOPE,"
WHERE THE HEADINGS
RELATE TO EACH OTHER.

Figure 1.
Implementation *planning matrix.*

Staff Training

Training staff and monitoring their performance are traditionally poorly done in quality systems. By emphasizing training methods, we eliminate much of the need for excessive written instruction. We need to recognize that many of the jobs in a seafood processing company are skilled ones and a comprehensive scheme to assist people in acquiring those skills is required.

Sealord puts considerable resources into staff training and development. It is important to note, however, that it is not just the opportunity to undergo training, but the opportunity to apply the training that is important.

Ownership of the System

In trying to meet the time frame set for certification, it is very easy for a quality manager to "hijack" the quality system. Doing all the writing, designing, and setting up is not working hard - it is being extraordinarily lazy. A person who has experience in a given area of an organization will know far more about the job than a quality manager and will almost certainly resent having a cumbersome system imposed without consultation or consideration to the realities of the job.

The role of the quality manager should be that of a coordinator, trainer, adviser, and supporter. It is one of those unique jobs where a person can be proud of having let someone else do all the work!

The focus of the quality manager should be on system design--coming up with a model for the system. The ISO standards are a good start but should not be followed blindly.

One of the big temptations that arises when setting up a quality system is to compartmentalize the procedures. In this approach, the only department that has to worry about the development process is the R&D department, the only department that has to worry about planning is the logistics department, and the only department that has to worry about quality is the quality systems department. The result of such a system is shown in figure 2: a company with no common strategic goals between different departments.

The aim should be to involve all departments in all of the areas of operation that affect them. The role of support and service departments therefore becomes one of

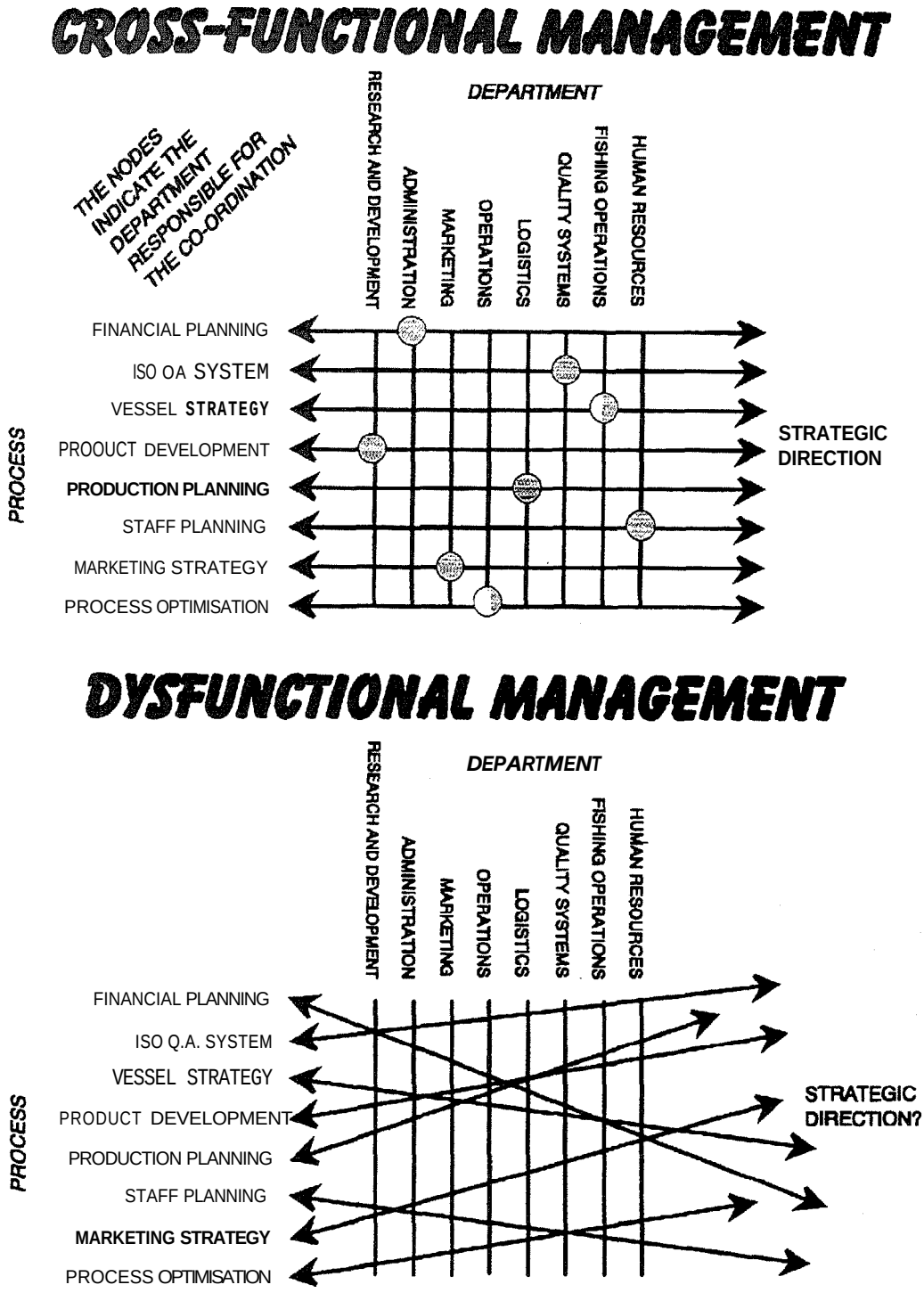

Figure 2. Organizational models.

coordinating activities throughout the organization. This means that the company is better able to focus all of its efforts on its strategic plan and runs a lower risk of departments' heading off on different tangents.

Sealord evolved a very simple model for its quality system, a model that relies on cross-functional management to make it work. This model is summarized in figure 3.

The process starts off with the product specification as the definition of customer requirements. This product specification is converted into processing requirements through detailed process specifications and work instructions, which in turn spawn raw material specifications.

After the raw materials are defined, process specifications and work instructions for the fleet come into play.

This process is controlled by the quality system, which ensures that other factors such as delivery requirements, pricing, and invoicing are incorporated into the production cycle.

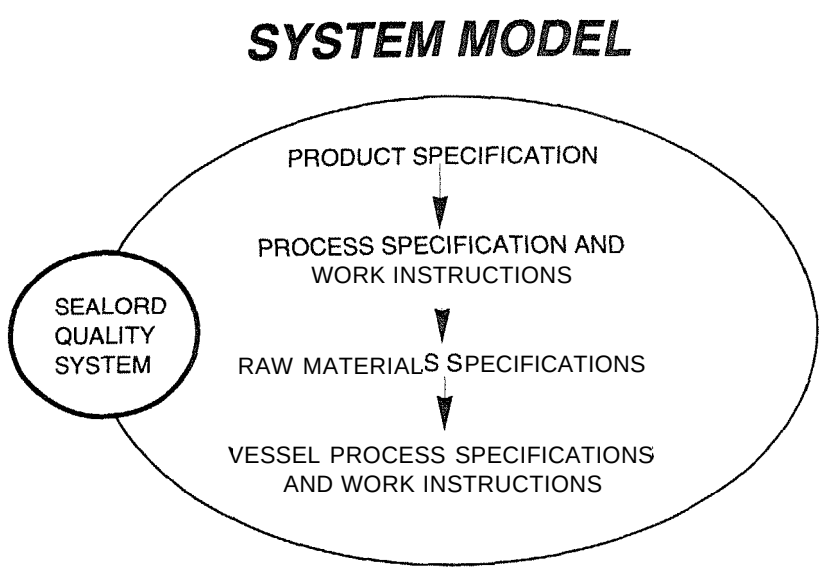

Figure 3. Simplified model of the Sealord quality system.

Internal Auditing

Along with staff training and management review, this is an area of quality system design that is often not done justice to. Without planning for an ongoing process of internal auditing, a quality system will inevitably start to deteriorate. Companies often tend to attack the internal audit by conducting widely spaced major audits. In reality, this only pays lip service to the concept of internal auditing. The aim of the exercise is to check on the functioning of the quality system to find problems before they start to cause failures in the quality system. Sealord uses continuous audits to monitor its systems. Each procedure is audited separately, products are audited, processes are audited, and records are audited. All of these audits are planned out only as far as the next audit - the frequency is varied to suit the level of confidence in the area being audited. Because the audits are small, less trained staff can be used, and this in turn reduces the negative connotations of an internal audit (since now almost anyone can be used as an auditor). Periodically a full internal audit is carried out to ensure that the overall system still complies to the standard.

Preparation for an External Certification Audit

No matter how well motivated people are, an external audit by the certification body will still be an intimidating experience. The purpose of the audit needs to be communicated to all staff. It will not be an interrogation; the job of an auditor is to help identify failures in the system that lead to problems in consistently satisfying the requirements of the customer, This of course leads back to selecting the right certification body in the first place, one that has auditors compatible with the culture of your organization, one that has experience in your industry, one that has a good reputation for looking for genuine problems with quality systems and not nitpicking over trivia.

And Whatever You Do. . .

Design a system that is easy to change and that can evolve; despite the philosophy of Deming, you'll never get it right the first time. Between the specifications and procedures, the backbone of the Sealord quality system contains several kilograms of paper. With the first print having taken place less than a year ago, Sealord is now up to the third revision of most documentation because people are actively and enthusiastically using and criticizing the system. If it is difficult to change, then the momentum will be dampened.

WHERE TO FROM HERE?

Recognition of Certification

After you have achieved certification, the next trick is to explain to people what it means. It's not bad news, and as a result media coverage will always be a bit of a problem.

Any organizations that are not already certified, or working towards it, will usually be poorly versed in the niceties of quality system certification They will congratulate you on achieving the "2001 Quality Award," ask you when you are going to upgrade your certification to ISO 9003, or ask you what ISO is anyway.

In practice it comes down to educating customers and consumers about what certification means. However, as more companies achieve certification, this will prove to be less of a problem.

Getting people to recognize the agency that certified your company continues to be a problem, and there don't seem to be many solutions on the horizon. This relates largely to the activities of national accreditation authorities-the groups that accredit certification bodies-such as RVC (Holland), RAB (United States), NACCB (United Kingdom), and JAS-ANZ (Australia and New Zealand)-which in many cases cannot agree on common requirements for certification bodies. If international recognition is important to your organization's certification, then it is a good idea to select a certification body that has a good reputation with your customers.

The Sealord Plan

At present, Sealord's certification covers the Nelson site, including the majority of the processing facilities, plus the company marketing and support functions. The immediate plan is to extend the certification to cover the fishing fleet and the subsidiary operations.

At the same time, Sealord wants to more fully use techniques such as quality improvement, HACCP (hazard analysis and critical control points), and the present icon of the quality profession, total quality management.

This fits in well with the current direction of the New Zealand seafood industry, which is looking at more fully incorporating HACCP into its fishing industry inspection and certification scheme.

Food Safety

One of the major strengths of the ISO 9000 series of standards is also one of its major weaknesses: it is not specific to any particular type of organization. One of the main areas in which this causes problems is food safety.

While setting up its Approved Supplier Programme, Sealord sent out surveys to all of its major suppliers and contractors. Many didn't have certification to a quality system standard and although disappointing, this was not surprising. The surprise came when questions were asked about food safety programs. Three questions were asked of ingredient suppliers:

- "Do you have a food safety program?" Predictably enough, all respondents said yes (they were hardly likely to say no, after all).
- "Do you use HACCP in your food safety program?" Half of the suppliers indicated that they did; the other responses varied from "not applicable" to "what is HACCP?."
- "Is your food safety program regularly audited?" The majority of suppliers said "no."

Further correspondence with and audits of suppliers have indicated a generally poor understanding of food safety. Similarly, HACCP is often seen as being a flowchart and a few notes about problem areas in the process.

Of course, HACCP is a far more potent tool than that. It provides a systematic way to evaluate the entire manufacturing process and develop control points to prevent problems that might jeopardize the consumer. Coming out of a thorough hazard analysis study is a plan that, if implemented through the quality system, will provide a high level of confidence in the ability of a manufacturer to control the safety of its products. The plan can be audited, both internally (essential if it is to be of any use at all) and externally, as the framework for regulatory control.

When implementing a quality system, it is better to start implementing HACCP sooner rather than later. HACCP will provide the logic behind much of the quality system (such as the control of purchased product, process control, process and product design, inspection and testing, product release, and product traceability). In tandem with an approach based on the marketing concept (ensuring a focus on contract review, production planning, product design, and distribution), a quality system that really works for the company will be far more certain.

Such an approach could also lead to more logic in the regulatory control. A system that encourages processors to assess the particular strengths and weaknesses of their operation must surely result in a more practical and workable system than a "one size fits all" mechanism that forces cumbersome and sometimes inappropriate controls on food companies. If HACCP does begin to form the basis of regulatory control, which seems to be a strong possibility, then this may also lead to mandatory certification programs for ISO certification. The important difference between HACCP and more traditional approaches is system ownership: in this scenario the processor takes ownership of the system

and is more likely to find it to be of genuine practical value.

HACCP will be one of the key components of food company quality systems in years to come.

Total Quality Management

At the 1991 Asia Pacific Quality Control Organization Conference, an Australian business studies lecturer, Thomas J. Fisher (1991), had the effrontery to suggest that quality management was not the only key ingredient to business success. Silence reigned as a hall full of quality practitioners struggled to come to grips with the possibility that marketing, accounting, exchange rates, and the like could actually have a significant impact on the viability of an organization.

While it is true that in a genuine quality culture, the ethic of not accepting, producing, or passing on defects will permeate all areas of a company, there has been a tendency for quality practitioners to poach the credit for business success in the name of quality management. That's fair enough in some ways - marketers, accountants, and economists have been doing pretty much the same thing for a lot longer - but it tends to confuse things rather than clarify them.

Sealord has a mission statement. It wants the philosophy of the statement to be adopted in all areas of the organization, and it wants to create a genuine synergy throughout all departments. Is this quality management? The answer is that Sealord doesn't care. It's a sensible way to run a company no matter what it's called.

TQM is the latest in a long line of buzz words. It is interesting that of the many companies that decline to formalize a quality system against a recognized standard, quite a number make a vague claim to taking the "total quality approach." Few companies seem able to elaborate on exactly what that means. In many cases, TQM is used as a weasel word by those organizations that are not really committed to the marketing-quality concept. No wonder Fisher had his doubts about the effectiveness of quality management programs.

One of the models that has been used at Sealord to try to show how the different techniques relate to each other under the umbrella of TQM is shown in figure 4. The concept is that TQM consists of two components - a philosophy and a set of techniques that are selected from the many available to best suit a company's specific needs.

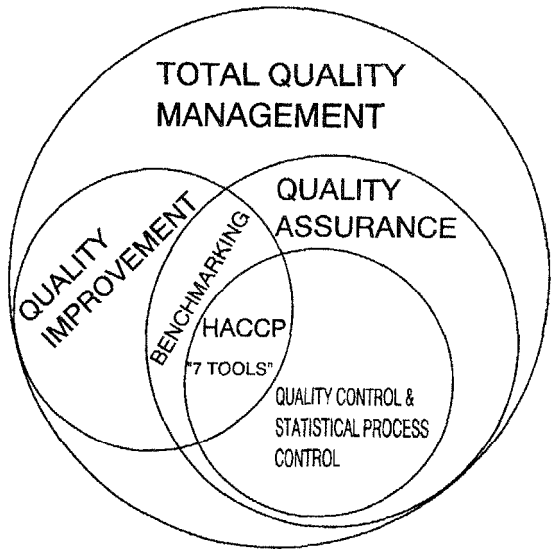

Figure 4. Interrelationships of quality concepts.

Setting up a quality system is a good, no nonsense start towards total quality. Initially the quality system will tend to be an add-on to the-day to-day operation of a company, but as time goes by, it gets absorbed into the normal operating methods. From there on it leads inevitably towards quality management: the system provides a way to lock in the changes and improvements that previously may have been lost once the initiator moved on.

Total quality management is very much in the plans of Sealord, but under a different banner - that of the Sealord way, the marketing concept, and sound business practice.

The Strategic Quality Challenge

The challenge that faces the seafood industry is one that is not uncommon in primary processors - the clash between production drive and market focus. The marketing concept in its purest form would dictate that a company should seek out its customers, determine its product mix, and then catch fish to suit. However, this is unlikely to use up all of the pieces of the fish and all of the species brought up in the nets. There will inevitably be a component of production drive behind the operation of any fishing company. This is not unhealthy so long as companies can find the right place on the continuum between being production driven and market led.

CONCLUSIONS

The single most important lesson learned by Sealord from its certification process is the importance of a holistic approach in setting up systems. Involve as many people as possible, avoid re-inventing systems where existing systems are in place, and make sure that the focus remains on building a quality system that works for the company rather than one that conforms to the standard.

The resources department of Sealord Products, responsible for the Sealord owned and chartered vessels, is currently in the process of formalizing its quality systems. This department is doing it because it can see clear benefits to Sealord in implementing such a program. The comments from the managers of the department have been along the lines of "We're not too worried about getting certification; we're mainly doing it because we need a good quality system." In Sealord the only person who worries about the ISO 9000 series of standards is the quality systems manager. Everyone else is concerned about creating a workable quality system that nurtures innovation and harnesses the inherent enthusiasm people have for trying to make their jobs better.

Don't make your company fit the standard; make the standard fit your company.

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QUALITY ASSURANCE STANDARDS TO IMPROVE MARKET OPPORTUNITIES FOR IQF FILLETS AND H&G WHITING

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It's an opportune time to talk about the quality assurance standard as it relates to the marketing of, in this case, headed and gutted (H&G) whiting and individual quick-frozen (IQF) whiting fillets. I'm not sure we've established the point where quality assurance standards apply to any marketable seafood product, but I feel I can speak with some authority on probably one of the most maligned seafood products on the west coast. When I started selling and marketing seafood products from the west coast about 15 years ago, the sum of a presentation was product, packaging, and price, and then price, and then price, and then price. It really didn't make any difference what the product packaging was; it was the price that did it. Price was, and continues to be to a great extent, the runaway locomotive that's pulling the whole industry behind it. I'm one buyer of seafood who is trying to put the brakes on that train, because if the industry's not healthy, I'm sure not going to be healthy. I'm not going to have anything to sell. Today that same presentation, whether I make it in Jasper, Georgia, or at Kroeger's headquarters in Cincinnati, or at A&P's headquarters in Montvale, New Jersey, covers fishing methods, improved processing methods, test marketing, target customers, packaging, and so on, and the last part of the presentation is about what it costs. If you haven't sold it by that time, it doesn't make any difference what it costs. You can't give it away, because space is too important and nobody is buying products strictly on price in the area where you can make a profit. Commodity products, as long as you continue to establish your products as commodity, are strictly price driven and market driven.

Last fall, at the end of the last whiting season, we did a test market involving about 400,000 pounds of IQF whiting fillets. I've been marketing whiting products for a long time, and what happened really surprised me. We packaged the fillets in 5- and 2-pound bags. The package was up-to-date on every specification from nutrition labeling to cooking instructions. We created a good-looking master case. We put together cases with a pack size that was acceptable to either a distributor out in the country or a food chain. We were fortunate to get enough distribution, working as hard as we could to ensure that the distribution worked out of the warehouse and into the stores so we'd get a good test. One huge distributor we worked with was a test market in himself because he distributed to large retail food chains, A&P stores, Cub stores, Pace stores, and so on as well as to the little stores out in the rural areas of Georgia and up in the mountains. Through him, we had a cross section of customers.

We found some things we should have known but didn't know. Number one, our largest customer base is the food store that's away from the major chains. If you take simple statistics, you know that 90 percent of the people in the United States are not wealthy. Not many of them are going to buy $6.99- or $7.99- a pound merchandise, even though those people go to the same doctors you do, have the same physicals you do, and hear their doctors say, "Eat more seafood; eat more poultry." Well, they're going to eat a lot of poultry because who can afford the seafood?

That basically was part of the presentation from Kroeger in Cincinnati to IGA in Dothan, Alabama. It works; it is so logical. These stores don't have a seafood department, and so these bags of IQF fillets became their seafood department. It was incredible to watch each week the movement go from 25 cases to 30 to 50 to 100 to 150 to 200 and on and on and on. The buyers became the best friends we had. They said they just couldn't believe this was happening. I told them I'd take back the product if it didn't work, but I thought it would work.

The 400,000 pounds I had for this test market went so well that by February I didn't have any more product. Now I had a bunch of very angry people on my hands. So, I had the idea of substituting product from Peru. Peru had the business before. They produce 2- and 5-pound bags of IQF skinless, boneless fillets. They sold so incredibly cheap that you couldn't compete

with them. After February, these distributors were at my throat. My salesmen were about to revolt because we didn't have your west coast product. I said "Aha, I've got the answer." So I sold them a truckload of Peruvian 5-pound product and a truckload of Peruvian 2-pound product. The distributors' customers revolted. They were sending the product back. All of a sudden they had a quality standard, a west coast product, and they would not take the product that they were taking before. They sent it back. I picked it up - 489 cases of 2-pound product - and was never so glad to do it in my life because if anything had proved our point, it was that. The incredible fact was that the Peruvian product was over 30 cents a pound less than the west coast product. I was blown away.

So when we're talking about quality, we should consider a circle divided into quadrants representing fishers, processors, marketers, and reorders. Now, the third quadrant is marketing. Quality is important. You're selling quality, and quality creates the continuity that completes the circle: you haven't done a thing until the end user buys your product again and again and the reorders start to come back into the plant. These four quadrants are like the brains, heart, lungs, and kidneys. You take one of them out and your business no longer has continuity. Quality is the continuity.

The west coast has beaten itself to death by selling price, strictly commodity products. There is no continuity to your business. You can sell to everybody this year, but next year somebody's going to be cheaper, somebody's got to move product, And so, you get it this time, you don't get it next time, and so on.

I think it's time we changed the face of our business a bit. We take an H&G whiting and we make fillets out of it, but we don't make just fillets, we make the best quality product we can put in a bag. We've got a better gauge bag than the Peruvian product. There are not as many broken packages. Peruvian product had a tendency to pop open because it's a thinner gauge. Ours is tough. It costs more, but it's tough. We have a better fish inside. We freeze it better, we take care of the product better. It's lighter and whiter. It's not dark like the Peruvian. We integrated brokerage into it. We integrated promotional monies into the price so that Kroeger, A&P, or anybody else can have "x" cents a pound that we accrue for advertising, into allowances, and so on. It's marketing dollars built into the price of product.

If we've done nothing else, we've paved the way in one respect - we've shown that you shouldn't sell yourself cheap. You have an excellent quality product. Years ago, the only thing we were told was that we had inferior fish. You could sell it as H&G and that's basically it. As a matter of fact, it was only a couple of years ago that I was wondering, if it's that bad will a whiting fillet hold together skinless? I was thinking it would just crumble and fall apart. If it's fished and processed right, of course it won't fall apart; it's an excellent product.

This test market confirmed exactly what we're saying about quality being the locomotive that's going to drive the train further and longer than price will. You want something that, number one, you can plan on. Now if I have customers with a brand name, they're going to buy it from me today, they're going to buy it from me tomorrow. So I can plan and my suppliers can plan; they can pack against orders. It's like Valhalla, but it works. The only way it works is for the whole circle to work together, from the fishers to the processors to the marketers. And after marketing, we hope, the customer will reorder and we'll go from there.

INFORMAL PANEL AND AUDIENCE DISCUSSION ON INTEGRATING QUALITY ASSURANCE INTO AN INDUSTRY ASSOCIATION

Session leader: *Jay Rasmussen.* Panel members: *Sigurdur Bogason, Ian Devlin, Tom Libby, Terje Martinussen, Jim Ostergard*

J. Rasmussen: I'm the director of an association of coastal governments, counties, cities, and ports along the Oregon coast. In the Pacific Northwest we are trying not only to maintain our traditional fisheries, but to enhance the role of fisheries in the economic lifeblood of the Oregon coast. This is the origin of the Pacific Northwest Seafood Association. With all the collective wisdom gathered here from diverse backgrounds, we want to talk about where quality control and quality assurance could fit into this association.

T. Libby: The primary concept of our vision was to develop an industry-wide, certifiable, quality standard program as a base to work from. Depending on the product and the market you're dealing in, you have customers who demand certain standards or certain specifications rather than product quality. You pack to size range, glaze percentage, count per pound, and whatever else might pertain. We want standards that provide certification to our customers, whether they are European or Japanese or domestic or Canadian, that will tell them this product is packed under Pacific Northwest Seafood Association standards and therefore is good. Few processors can provide the total volume that a single buyer might want. The association could be involved in matching buyers who want large volumes with processors who can produce part of that volume. We need continuity of quality. Another part of this effort is name recognition similar to that which Tillamook has established in dairy products,

R. Williams: Quality assurance won't work if it's not market driven. The people who market the product should be the people who set the quality standards. We need to specify what quality standards will be. Do they need to be set by scientists or by people who are marketing a product line to the public? What drives those standards is the customer.

J. Rasmussen: Is it possible to establish standards with all the variety of product that you have coming in? There must be some minimum level standards. You aren't going to sell Icelandic fillets that are far below what people have typically bought, even though you may be adjusting to your customers' needs.

S. Bogason: Our group has specific standards. We don't sell fish below those standards. Our minimum standard is actually a little bit higher than the government standard because we have a marketing company. If you're selling a low-grade product, forget it.

G. Sylvia: One reason Pacific whiting has been called a low-grade product is that it's hard to control the quality. The efforts in the last few years have improved the product quality. Some techniques used have been refrigerated seawater systems, fishing short tows, and catching and processing quickly. Now the question is, What are the minimum standards that the association wants to establish? Individually, you may want to set higher standards or adjust to specific buyer needs. Those are the kinds of questions the industry has to deal with.

C. Gorga: The issue is not simple. There must be a process. The entire industry has to get together and decide on the standards. The first thing is to distinguish between quality control and quality assurance. Quality assurance keeps the consumer in mind, and quality control thinks of the next buyer. There are many subtle differences between the two, but that is the key. Next you must discover what the consumer will accept. Scientists can tell you what is possible from a technological point of view. Each market has certain sociological requirements that must be taken into account. There was an example this morning of the Alaskan Natives wanting a certain type of fish that is not accepted by the controllers. Quality

assurance is an agreement between the controllers and the processors and the fishers. Quality assurance is a process, not something that some dictator proclaims. What is essential to this process is collecting market information and developing some kind of a feedback loop so the information can be used in forming quality assurance programs.

R. Williams: The Pacific Northwest Seafood Association will complete the circle by serving as a marketing association. Fishers and processors will have direction in standards and trends. The image of Pacific whiting has already been changed. You and I are the ones who should set the standards. In a controlled regional test market, we found that customers loved five-pound packages of skinless, boneless fillets. The association will be able to keep this kind of standard and not kill the market with either too much product or inconsistent quality. We want to expand the market, not kill it.

P. Howgate: I wanted to give examples of trade association types of quality assurance that might have some lessons for you. One is the Scottish Salmon Growers Association, which has a quality assurance scheme for the whole industry; this scheme covers the final steps of harvesting and packing the salmon-confirmation of size, grade, blemishes on the skin, correct packaging, and residue information for exportation. The product can then get the logo stamped on it, announcing approval by the Scottish Salmon Growers Association. The Scottish Salmon Smokers Association wanted a quality logo on their product too. They consulted the institute where I work and we drew up a code of practice and instituted an inspection scheme. The first round of inspection was pitiless; we even failed the president of the association because he did not conform to the standards the association set.

Another trade group is the Shetland Fish Producers Association. The Shetland Islands considers everything that goes from there as exported. The industry has set up a small quality control unit with about three inspectors in a small technical laboratory. Their plants are well operated in terms of hygiene and such. The plants are approved and given the Shetland Quality Assurance Company logo, which is assurance to the customer. These programs have to be marketed because there's no value in having these controls unless your customers know what you mean.

More people are asking, "If I'm going to pay this much, how do I know it's going to be good?" This is the demand. When profits are high and fish has become a luxury food, the customers quite rightly want assurance that they're not wasting their money. We know that big profits are fragile in terms of storage in ice or in a frozen state. Fish must be handled with more care than other protein foods. The industry has not been giving this assurance to the customer.

C. Gorga: I have three comments. First, the assurance has to be serious, which means hard and tough. There must be a pledge of giving a refund to an unsatisfied customer. You should never reach that point, but it must be that strict. Second, the logo will be your way of excluding the processor or fisher who will not respect your standards. You must control that power because it is the logo that will assure the consumers. That logo has to be true; it has to say, "Yes, this is really high quality." This becomes an enforcement of your quality standards because those who do not meet those standards must be excluded from receiving the logo. The third point is that we do have standards. We have U.S. grade A quality from NMFS.

T. Moreau: This is an excellent opportunity for you as an association to work with my agency. You've got to be up front. We need to discuss shelf life and performance because if we sell the military a bad item they're not going to buy it again. The requirement is meeting the grade A standard. The military is interested in Pacific whiting because it is a developing fishery and because of the quality improvements.

You can grade in accordance with the NMFS system without having an inspector continuously present during processing. There are costs, but they are only a fraction of a cent. What you have to consider is that even with these rough estimates, the cost of quality was about 10¢ a pound. But you could sell that same pound of fish for a dollar more.

T. Libby: When it comes to the point when we are satisfied with quality standards and plants agree to the standards, we should separate ourselves by emphasizing the differences of

Pacific whiting from the rest of the pack. If we put an identity on our fish and build consumer trust, we're making our own market.

M. Morrissey: The Scottish Salmon Growers' quality assurance program is more in line with good manufacturing practices than the end product evaluation, which has merit; but I think there's more. With Pacific whiting, even if you have good manufacturing practices all the way through, you might have some inherent variation that could result in high protease activity or other problems that lower quality even though it was produced under the seal of approval. Possibly what is needed is a combination. You might have to include all handling: at sea, in the processing, and on down the line.

P. Knight: The Pacific whiting going to market now is better quality than a few years ago when we used dry pumps. There have been a lot of advances in technology in harvesting and processing whiting. Another improvement is the emphasis on marketing.

T. Moreau: I'd like to go back to the question of the quality requirements of the military, They buy quality products, and they know that they pay for costs that are incurred to get to the quality level they want. They have done that for years and will continue to. They're looking for new species of fish. One of the things they're not looking at is value added. They want traditional fillets because they already have their recipes, and their recipes are almost sacred.

T. Libby: I'd like to ask those of you from other countries if you think we're headed in the right direction. If not, which way should we go?

T. Martinussen: You need to analyze the situation and then improve step by step. With standards, people are paid according to quality criteria. What are those criteria that consumers are willing to pay for? All processors need to pay according to quality. Those who fall below the standard should be warned and told what criteria they must meet. The policy of the association should be to give information about how to improve the processing and quality to get the best price out of a product. You need to control all the factors. You need a system for identifying the products and the producers, so you know who is responsible. If there's a problem, you can go back to that processor and the processor, not the association, will be responsible,

G. Sylvia: One of the issues this association is grappling with is enforceability. That's where the largest cost is going to be. Members of the association could sit down with the work of marketers and other factors and start to look at what the standards would be. We're doing some studies to look at what the costs will be to develop those standards. Can a program work without enforceability? The concern is that if we develop a common label across all plants, but one of those plants falls below the standards, that would smear other producers who did meet the standard and ultimately lower the price. We want to make sure that doesn't happen.

P. Howgate: The whole business of an association-type logo is buyer confidence. The association's reputation will back up your quality, but you've got to advertise to make public what your standards are. Enforcement is crucial. Financing is crucial. The Shetland association is financed by a levy on the value of the fish. I don't have an exact amount, but I agree with Tom Moreau that it's really a small amount of the total value. The Shetland system has been in existence for some time, so they must be able to recoup that levy by the additional value they can get by saying this has come from Shetland.

C. Gorga: It all depends on the rules and regulations governing the association. You set them up through the process of getting all the major players in the same room and developing the standards. After the standards are accepted, they must be enforced.

R. de Beer: What it mostly sounds like is the seafood association here really needs quality management systems itself to work with the processing companies. You need to develop standards and codes of practices and then have an auditing system from this organization.

Member of audience: As a bureaucrat in the midst of all the processors, one thing that did strike me is that quality lost cannot be regained. The traditional fishing fleet needs particular attention. The industry must be aware of the whole process, from when the fish first leave the water, through the boats on to

the plants; all these factors need to be built into the standards.

Member of audience: There have been similar discussions in Alaska for half a dozen years on the use of a seal. It always comes down to this: the value of the seal is only as good as the weakest player. If you don't weed out people who aren't going to conform, the value of the seal and all that money can just be blown out by the first guy who decides to take shortcuts.

Seafood Quality Assurance Programs: Design, Implementation, and Managerial Strategies

USING TQM PRINCIPLES TO IMPLEMENT HACCP

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INTRODUCTION

The recent emphasis on helping people do better in the business environment has resulted in a relatively new approach to group process called total quality management (TQM). TQM is a "people system" that provides the opportunity for individual employees to effectively contribute to planning, implementation, operation, and continuous improvement of company operations.

The principles of TQM are most appropriate for the effective development and implementation of new company programs such as the hazard analysis and critical control points (HACCP) system. HACCP is a systematic approach to food safety (Codex 1991; ICMSF 1988; USNACMCF 1989; 1992). It is organized for use by teams but is primarily a technical procedure for the identification of potential hazards for a food and development of the means to prevent or control the hazards in the food manufacturing and marketing system.

This paper contains a short discussion of TQM, quality assurance, and the use of TQM principles for HACCP implementation. TQM group process techniques will be illustrated for preparing the HACCP plan and for implementing the HACCP system for the ingredient procurement, production, distribution, and retail sequences for bringing a reliably safe food product to the consumer.

TOTAL QUALITY MANAGEMENT PRINCIPLES

Total quality management is defined as "a philosophy, a set of concepts and a collection of methods for continuously improving organizations" (Golomski 1992). An organization that uses TQM in its operations would create an Operating environment for all company employees based on the following principles:

- Customer-driven quality - a strategic concept
- Leadership--sustained support by senior management
- Continuous improvement - applied to all operations
- Full participation - committed and empowered work force
- Fast response-reduced project-cycle time
- Design quality and prevention - problems prevented by building in quality
- Long-range outlook - goals, plans, and application of resources
- Management by fact-decisions based on reliable data and analysis
- Partnershipdevelopment - everyone works together
- Public responsibility-corporate responsibility

These 10 principles are the core concepts of the Malcolm Baldrige National Quality Award Criteria (Surack 1992).

TQM provides the ground rules to encourage an effective group process for people in a company to plan, develop, implement, and operate systems or programs such as HACCP. In particular, TQM emphasizes the establishment of goals, leadership, an environment of prevention and continuous improvement, and the opportunity for everyone to work together in groups and teams to accomplish common goals and objectives.

THE COMPANY QUALITY ASSURANCE PROGRAM

The company quality assurance program, sometimes referred to as the "umbrella" for product safety, regulatory compliance, and product quality systems, is illustrated in table 1. The table indicates that product safety is a mandatory program, where HACCP is the operating system and the type of monitoring is for critical control points (CCP). A CCP is defined as "a point, step, or procedure at which control can be applied and a food safety hazard can be *prevented, eliminated, or reduced to acceptable levels"* (USNACMCF 1992).

The other activities that fit in the umbrella quality assurance program are regulatory compliance and the product quality system. Note that these systems are required or voluntary and do not always require a critical control point for monitoring. Product quality monitoring usually requires monitoring by control points (CP), defined as "any point, step, or

Table 1. Types of activities clustered under the umbrella company quality assurance program.

	Product Safety	Regulatory Compliance	Product Quality
Importance	Mandatory	Required by Law	Voluntary
System	HACCP	Regulations	Quality Control
Type of Control Point Required	Critical Control Point (CCP)	Critical Control Point (CCP)* or Control Point (CP)	Control Point CP)

* A CCP would fall under regulatory compliance when it would involve product safety. It would be both in the HACCP and Legal Compliance systems. An example would be the legal requirement for a pH of 4.6 or less for the safety of an acidified canned food. Control points (CP) would be used for legal requirements that do not involve product safety.

procedure at which biological, physical, or chemical factors can be controlled" (USNACMCF 1992).

There are other programs that are considered parts of the umbrella quality assurance system and are related to product safety and regulatory compliance. They include application of the good manufacturing practices (GMPs), environmental controls, control of toxic substances, labeling, and analytical testing.

INTEGRATING HACCP INTO THE TOTAL QUALITY ENVIRONMENT

HACCP is a preventive approach to food safety assurance that requires the education of persons using the system, analysis and planning, coordination of different departments in a company, and above all, an attitude of dynamic improvement and action. This modern approach to food safety is greatly facilitated by the total quality management environment.

Table 2 lists the complete sequence of organizational events and actions necessary for implementing the HACCP system in a food facility. Note that although management begins the process, subsequent development and responsibility is delegated to the HACCP coordinator and the core HACCP team, to product-specific HACCP implementation teams, and ultimately, to the line operators.

The actual integration of HACCP into the existing TQM environment begins with sustained support from top management. Management must be involved to set the example because HACCP-TQM is motivational. If people are not motivated to keep food safe, technical development of the safety system is seldom successful. Management must initiate the TQM process by clearly stating food safety policy and goals, which may appear as follows:

Food Safety Policy: "All company food products will be safe for consumption."

Food Safety Objectives:
1. "The company will plan and implement a HACCP system for product safety."
2. "The HACCP system will be operational by _____" (a stated future date).

The next step is for management to appoint the core HACCP team, which initiates the actual development of the HACCP system. The core team may be appointed at the corporate or manufacturing facility levels. It oversees the development of HACCP plans, training, translation of the plans into manufacturing practices, start-up, and continuous operation and improvement of the HACCP system in the company.

The team is composed of 7 to 10 people representing a cross section of the manufacturing group. The HACCP team coordinator is usually the quality control manager for the company or plant. The team may consist of two or three manufacturing supervisors and operators and quality control, purchasing, maintenance, sanitation, and distribution personnel. Other persons from outside a facility may be

Organizational	Actions
Management	* Policy • Objectives * Appoint HACCP coordinator * Train coordinator and team
↓	
HACCP coordinator and core HACCP team	e Develop HACCP project plan * Develop initial HACCP plan * Appoint product teams . Conduct training for teams * Assist product teams
↓	
Product teams	* Develop product HACCP plans * Develop operator procedures • Plan operator training * Conduct trial test runs * Help line operators start HACCP
↓	
Line operators	. Monitor individual CCP * Take corrective action * Do most record keeping • Help improve system
↓	
Management and core HACCP team	• Verification • Update and revise HACCP plan

Table 2. Sequence of organizational events and actions necessary for implementation of the HACCP system in a food facility.

on the team, such as members of corporate product development and quality assurance.

This core team uses the TQM process of meeting and operating as a group. In some companies, the team has a leader and a facilitator. All persons are given the opportunity to participate in the planning, discussion, and actions of the group. The core HACCP team may appoint other teams to develop HACCP plans and systems for specific products produced at the company or in the manufacturing facility. Sometimes members of the core HACCP team serve as the team leaders for the satellite groups. These groups are sometimes called manufacturing teams.

MANUFACTURING TEAM DEVELOPMENT OF THE HACCP PLAN

A. Description of HACCP

The definition and seven principles of the HACCP system are given in table 3. The HACCP system sets forth a systematic procedure for development and documentation of the food safety controls for a specific food.

Five preliminary steps are necessary before application of the HACCP principles (USNACMCF 1992). These steps guide the team in developing the information needed to apply the seven principles. They are as follows:

1. Assemble the HACCP team.
2. Describe the food and its distribution.
3. Identify the intended use and consumer of the food.
4. Develop the flow diagram.
5. Verify the flow diagram.

Following these steps, the team develops the hazard analysis (also termed the risk assessment), HACCP principle 1, consisting of the review of multiple risk factors for each step in a food process (USNACMCF 1992, Appendix A).

An important point to be made concerning the hazard analysis is that the teams will need the assistance of technical experts for in-depth information on microbiological, chemical, and physical hazards. Expert information supplements the team's "real world" expertise with the actual production system and processing technology. The hazard analysis helps the team to examine *each step in the process* to identify potential hazards and to develop the means to prevent the hazards.

As noted in table 2, development of the HACCP plan is a first priority. The HACCP plan is defined as "the written document which is based upon the principles of HACCP and which delineates the procedures to be followed to assure the control of a specific process or procedure" (USNACMCF 1992).

ACCP
inition
ples.

Table 3. HACCP system definition and principles.

HACCP is a systematic approach to food safety consisting of seven principles:

1. Conduct a hazard analysis. Prepare a list of steps in the process where significant hazards occur and describe the preventive measures.
2. Identify the critical control points (CCP) in the process.
3. Establish critical limits for preventive measures associated with each identified CCP.
4. Establish CCP monitoring requirements. Establish procedures for using the results of monitoring to adjust the process and maintain control.
5. Establish corrective actions to be taken when monitoring indicates that there is a deviation from an established critical limit.
6. Establish effective record-keeping procedures that document the **HACCP** system.
7. Establish procedures for verification that the HACCP system is working correctly.

Source: USNACMCF, 1992

B. Example HACCP Plan for Fish Fillets

I'm using selected parts of a model HACCP plan for refrigerated fish fillets to illustrate the results of the HACCP team's work. The hazard analysis has already been completed by the team. The next six figures illustrate the action-oriented parts of the HACCP plan that are used for the product-specific HACCP system. Figure 1 gives examples of the results of the hazard analysis for fish fillet production. This shows five selected production steps, potential food hazards identified at the specific step, and preventive measures.

Figure 2 illustrates the types of CCP that were developed from the preventive measures that include the description of the critical control point, its critical limits, the monitoring activity, and corrective action.

This figure illustrates the parts of the HACCP system that are used on the production line to monitor the application of food safety controls and to apply corrective action if monitoring indicates that a CCP is out of control. Note that the core HACCP team has made these action parts of the HACCP plan, such as "stop the line" and "immediately place the food on hold" - very specific and straightforward. This clarity is necessary for people who must take corrective action when action is required. Also, note that the HACCP plan (in the example) is extended to the refrigerated trucks used in distribution and to the retail refrigerated display cases.

Parts of the HACCP plan not shown are record keeping and verification. Record keeping is fairly straightforward, its objective to make sure that the HACCP system, and particularly monitoring and correction actions (requiring deviation control), are documented, signed off by the operator and management, and kept in a secure but accessible location in the facility. Verification is also planned and is based on review of the HACCP plan, records, observation of the operation of CCP, and if desired, analytical testing to verify that CCPs are under control.

CONVERTING THE HACCP PLAN INTO PRODUCTION PROCEDURES

Converting the HACCP plan into the procedures needed on the production floor is accomplished by the more conventional TQM procedures used to establish new programs and to achieve the benefits of continuous daily improvement. Central to the establishment of HACCP is a project plan that lays out the sequence of events leading up to start-up of the HACCP system (as given in table 2).

By far the most important phase of establishing HACCP in the production system is translating the HACCP plan critical control point information (i.e., critical limits, monitoring, and corrective action) into procedures for people to use on the production floor. TQM is most effective when the teams develop the

Production Step	Identified Hazard(s)	Preventive Measure(s)
Raw fish	Potential: microbiological chemical, and physical hazards	Establish and enforce specifications for receipt of raw fish
Inspection	Metal contamination	Metal detector
Cooking	Survival of hazardous microorganisms	Correct cooking procedure (such as time and temperature of the cook)
Trucking (distribution)	Temperature abuse and growth of hazardous microorganisms	Chill truck to < 35° F before loading; monitor compartment temperature
Retail display	Temperature abuse and growth of hazardous microorganisms	Maintain product in refrigerated food case at < 40° F; do not exceed shelf life.

* Preventive measures for other steps and identified hazards could include refrigeration; sanitation; protection from cross-contamination from raw materials or sources of microbiological, chemical, or physical contamination; correct employee hygiene; and other means to prevent food hazards.

Figure 1. Examples* of the results of a hazard analysis for fish fillet production.

CCP Number	Monitoring	Corrective Action
No. 1: Adherence to purchase specifications	Comply: each lot	If not in compliance: reject lot
No. 5: Metal detector	Continuous	If metal detected: • Stop line and correct cause. • Hold food and dispose of safely.
No 11: Cook time and temperature for food (one minute @XXX° F)*	Continuous: time and temperature recorder	If low time or temperature: • Stop cook and correct cause. • Immediately recook or hold and dispose of safely.
No. 21: Precool refrigerated trucks to 4.4° C before loading product	Before each load	If truck temperature is above 4.4° C: Do not load truck until it is cooled to 4.4° C.
No. 22: Retail product temperature 4.4° C and shelf life	Each week	If temperature exceeds 4.4° C or if shelf life is exceeded: • Work with store to lower temperature. • Remove product.

*Temperature to be determined experimentally for size of portion and type of cooking system (that is, deep fat frying, oven cook, grill, and so on).

Figure 2. Examples of monitoring and corrective actions for CCPs.

- HOW IS THE MONITORING INSPECTION CONDUCTED?
- MUST EQUIPMENT BE DISMANTLED?
- WHAT IS LOOKED FOR?
- HOW WILL THE INSPECTION PERSON DETERMINE IF THE CRITICAL LIMIT IS IN SPECIFICATION?
- HOW WOULD YOU TELL A PERSON TO MONITOR THE CRITICAL CONTROL POINT?

Figure 3. Guide for preparing operator procedures for monitoring for one critical control point.

. IMMEDIATE CORRECTIVE ACTION FOR THE MANUFACTURING LINE?

* WHO DOES THE PERSON NOTIFY AND WHEN?

. IMMEDIATE ACTION TO PLACE PRODUCT ON SECURE HOLD.

* WHO DOES THE PERSON NOTIFY THAT PRODUCT IS ON-HOLD AND WHEN IS NOTIFICATION DONE?

Figure 4. Guide for preparing operator procedures for corrective action when monitoring indicates that the CCP is out of control and a safety hazard may exist.

wording for operators to use in monitoring and corrective action. The teams are encouraged to involve the hourly workers in testing and working out the bugs in the new procedures for the CCPs. Figure 3 provides a guide for the development of monitoring procedures, and figure 4 is a guide for corrective action procedures.

Completion of "floor" procedures makes it possible to begin the trial runs that are used as a shakedown of the new system. They may be initially started on one line. The core HACCP and the product teams monitor the trial runs and may need to go back to the drawing boards on occasion to make procedures more explicit. Sometimes the teams discover that a critical control point cannot be monitored because no one realized that the equipment could not be opened or disassembled for inspection. It may take several months to work all the bugs out of the new HACCP system, and it is not unusual to discover many potential safety problems that were not noticed before the use of HACCP. The use of TQM provides for continuous review and refinement of the HACCP procedures used by food processing personnel.

ADVANTAGES OF USING TQM PRINCIPLES TO IMPLEMENT HACCP

TQM makes the scientifically proven HACCP system available to company employees. Because employees prepare the HACCP plan, they are knowledgeable about transforming the plan into food safety action procedures. Increased awareness is created when a large number of people are involved in developing the HACCP system. This involvement appears to gradually establish new behavior towards continuous product safety assurance.

The HACCP-TQM approach is particularly effective in helping to prevent catastrophic public safety exposures and product recalls. These episodes are rare and sporadic, but they may be extremely serious, causing injury and death. Prevention is the key, and experience has demonstrated that maintaining product safety requires a carefully planned food safety program and active participation of every company employee. Combined TQM-HACCP techniques are applicable to large and small companies alike. Industry associations can assist smaller companies by helping to establish model HACCP system plans that streamline implementation.

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ESTABLISHING PROGRAMS TO MEASURE QUALITY ASSURANCE

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WHAT DO WE MEAN WHEN WE TALK QUALITY?

America is noted for creating "buzz words" and hot concepts without taking time to understand them. For the last half of the 1980s, one of these magic words was *quality.* Look at any seafood publication and you will notice that every company advertising in it claims to produce quality products. However, if you surveyed the average person on the street, you would hear a lot of horror stories about seafood. I think we all agree there is room for improvement. The question is, how do we make that improvement? We do it by having a quality assurance program, or as I like to think of it, a quality improvement system.

Quality is really about customers: how a company gets them, how they are treated, and how they are kept satisfied. Ultimately, the company's success with customers determines whether it succeeds or fails. There is an old saying, "If it isn't broke don't fix it." At face value this seems to make sense, but what it really says is don't worry until things totally break down. That's not a very good way to keep customers happy. I'm going to talk about ways not only to make sure things don't break but to improve them.

SOME BASIC TRUTHS OF QUALITY

There are some basic truths that relate to quality assurance programs, whether they are in the seafood, automobile, or electronic industry.

First and foremost, a quality assurance program works only when top management is committed to it and drives it. If the company's CEO does not push the program, it will never be truly effective. The employees will quickly figure out the true priorities and act accordingly.

Second, the process will not succeed without the involvement of the company's employees. Wherever quality improvement programs have been successful it was because the programs involved the employees. People respond in kind to the way they are treated: if management's approach is to treat the workers as mindless robots that can be trusted to do only what they are told, it isn't surprising that the employees don't show any initiative or come up with innovative ideas. On the other hand, if they are told what the goals of the company are and why things are done a certain way, they are much more likely to notice what is happening and let supervisors know when problems arise. They are also much more likely to suggest improvements to the equipment or procedures.

Seafood processors have more difficulty than other industries in instituting this part of a total quality program; they employ many seasonal and short-term workers, and there also are often language problems. Even short-term employees, however, work better if they feel their thoughts are valued and they understand why things are done the way they are. Don't dismiss them as worthless because they are temporary. Other important sources are the longer-term employees, such as maintenance engineers, mechanics, office personnel, and production line leads. Whatever your situation, remember, the ideas are there; you just may have to look harder.

Third, you cannot inspect quality into a product. The people who check samples at various stages of production are only telling you how you are doing; they are not improving the quality of that product. The only way to improve the product quality is to have a formal quality assurance program.

Fourth, quality does not cost money. To establish a quality assurance program or intensify the one you already have may increase costs briefly, but time and time again it has been shown that the payback more than exceeds the costs. The key to getting this payback is to use the information gathered. This is the critical step often not taken in the seafood industry.

Fifth, quality control is not quality assurance. Having a system of technicians performing tests and making records does not constitute a complete quality assurance program. Without a system to incorporate the information gathered into an overall master

plan, there will not be much progress. As a corollary, this conference includes several discussions about HACCP. HACCP is an excellent concept. However, when it is designed solely to achieve regulatory compliance, it is not a quality assurance program.

WHAT IS QUALITY ASSURANCE?

Quality assurance is a systematic approach to organizing your thoughts when reviewing a production process. Its purpose is to enable a company to produce products better and cheaper. It is also designed to allow the plant to maximize its financial revenues from the products it produces.

It basically involves four steps:

1. Planning. Determine where you want to go and what you are going to do to get there.
2. Testing. Implement the plan. This is often done on a trial basis. Keep complete records of the tests.
3. Reviewing. Review what you did using the information you gathered.
4. Modifying. Plan any changes that you find are needed based on your review. During this step, keep in mind the goal you established earlier.

The last step returns to the first step and the process repeats itself.

WHAT IS THE DIFFERENCE BETWEEN QUALITY ASSURANCE AND QUALITY CONTROL?

There is often confusion about the difference between quality control and quality assurance. A quality control program is only one part of a complete quality assurance program. Quality control is the system of checks and tests that are conducted throughout the plant to determine the status of the fish and related products during the processing.

Quality assurance, on the other hand, is the systematic process that was followed to develop and define the quality control program. It is also the system that is used to monitor the effectiveness of the quality control program. It is the way information from external sources such as customers, ingredient suppliers, comparative cuttings, and regulatory agencies is gathered, analyzed, and turned into the quality improvement program. Quality control tells you where you are. Quality assurance lets you determine where you want to go and how far you have to go and sets up a road map to get there.

Quality assurance also includes a procedure to audit the quality control program. This is combined with the feedback described previously and used to evaluate the effectiveness of the overall program. In addition it is critical to obtain feedback from the plant personnel actually living with the program. Can the technicians performing the testing think of some important areas that are being overlooked? Do production managers have suggestions for minimizing the testing's impact on production? What do the plant engineering and maintenance staff think about the identified areas of concern?

A quality assurance program is dynamic. To achieve maximum effectiveness, it needs to evolve. That evolution must be reflected in documentation. Feedback from the customer must be actively sought. That information must be quantified and compared to the original goals and premises used to develop the quality assurance program.

For the seafood industry that feedback comes not only from the customer; the plant must also be aware of the concerns of the various regulatory agencies.

In the early days of the seafood processing industry, the whole decision-making process was much easier. The company president discussed production and quality problems with the vice-president over dinner and then explained any changes to the workers when they tucked them into bed at night. Today the system is much more complex.

COMPONENTS OF A SEAFOOD QUALITY ASSURANCE PROGRAM

The goals and objectives of the company must be understood. Usually the most basic goal is to stay in business. For seafood this means selling the product for more than it cost to produce it. It means repeat sales to repeat customers and getting the maximum value for all products. The quality assurance plan begins with this basic understanding.

The first step is to determine the customer's needs for the products you produce. There are several aspects to this. What are the quality levels the customer wants, and more important, what attributes does the customer consider in determining quality? For example, how important are things like scale loss, meat color, oil content, and the fat layer on whitefish? What product size classification does the

customer want? How is the product to be prepared? What about processing style? Consider packing style and container size. Warehouse stores such as Costco and Pace have created a demand for container sizes that were not used in the past, and those companies that adjusted their production fastest have secured a vast new market.

ESTABLISHING THE QUALITY CONTROL PORTION OF A QUALITY ASSURANCE PLAN

The first step is to outline the entire process, just as you would if you were setting up a HACCP plan. Then assign risks following the same procedure you would use for that program, but when you think of the "risks or hazards" associated with each point, don't limit yourself to questions of public health. Expand your analysis to consider whether the step can affect the customer's satisfaction with the product. A step may have little or no health consequences but may significantly affect the price you get for your finished product. An example of this is mishandling salmon - grabbing and lifting them by the tail. This causes bruising, which has no public health significance but which destroys the value of the fish for sale to a smoker who is going to split the fish.

When you have finished outlining the steps, assign them risks, using whatever value system you prefer. Common choices are numeric, meaning 1, 2, 3, 4, and 5, and descriptive, using terms such as *aesthetic, minor, major, serious,* and *critical.* Decide the risk levels you will maintain records for and give thought to the practicality of the records you plan to use. Records will not prevent something from going wrong. The quality control checks and plant operating procedures serve that function. The reasons for keeping records are to minimize the impact of any difficulty that may develop and to learn from it. The records should be complete enough that you can use them to determine what went wrong and when and how much product is affected. They should show when and how a problem was corrected. They allow analysis of the scope and nature of the difficulty so corrective action can be targeted to the appropriate area.

Balanced against the need for records to be complete and comprehensive is the problem of overkill. It is very easy to make so many records that the number of technicians required to fill them out increases the plant's overhead to the point at which it is no longer competitive and the purpose of keeping the records in the first place is defeated because no one looks at them or understands what they represent.

A final comment on quality control checks. To have maximum value, all tests must have a valid statistical basis. This means the sample size must be large enough to be statistically valid and the lot sampled must have common characteristics. A sampling manual such as ***Military Standard 105E*** is a must.

SOME SIMPLE QUALITY CONTROL CHECK POINTS

To give you an idea of how a quality control program can be developed for seafood, I'm going to list some check points to consider. I'm sure that with some thought you can identify others not mentioned. When reviewing your process, remember the basics of maintaining good quality seafood:

Keep it cool.
Keep it clean.
Keep it moving.
Handle it carefully.

By using these guidelines, you can tailor a quality control program to a particular plant.

INCOMING PRODUCT QUALITY

For seafood, this is the most critical area. It is not possible to improve the quality of a fish above the level it was at when received. The best you can do is minimize the rate of decline. The concerns at this point may not be related to public health. For example farmed catfish are brought to the plant live, so there is no concern about decomposition. They are sampled extensively, however, for quality because fish in some ponds may develop strong, muddy odors that make them far less valuable. Another example of a quality problem that does not concern public health but that should be detected at receiving is chalky black cod. The critical criteria for your raw product should be outlined and the test procedures designed to check for those criteria.

Any incoming materials used in the processing should also be inspected. Are the packing cartons being used what you specified? What about the liners?

PRODUCT QUALITY WHEN SEAFOOD IS ACTUALLY PROCESSED

In situations where the fish are not held for long before processing, such as factory trawlers, trollers freezing on board, aquaculture plants, and processing plants that are able to handle the fish without storing, it is not necessary to check the fish a second time. There are other situations, however, where the fish may be stored at the plant for a day or more before it is processed. In those cases, it is important to check the fish a second time, to make sure of the quality and suitability when it is actually being worked.

IN-LINE PROCESSING

Check the effectiveness of the butchering and dressing steps. Include a feedback procedure to let the workers know how they are doing. If the head cuts are too long, let them know. If there are 10 butchers and you find every 10th fish has viscera remaining, it is probable that one of them was not given complete instructions on how to clean the fish.

MONITOR THE GRADING STEP

This is one of the most critical steps in the process in terms of maintaining customer satisfaction. A good quality assurance program includes a program of statistically based sampling of the graded product. Nothing makes a customer madder than receiving a grade **2** product and being charged for grade 1. If the plant packs for several different buyers, each having slightly different product criteria, you have a problem waiting to happen. An approach I have seen effective at this point is a series of wall charts that list the grading criteria for each buyer or pack style. If the grading is not checked, you don't really know what is being shipped to your customer.

FINISHED PACKAGE CHECKS

Just as it is critical to monitor the effectiveness of your grading, it is vital to check the condition of your product as it leaves your plant. You need to know that the product is packed the way it is supposed to be, the containers are correctly marked, they contain the proper amount of product, and the packaging is correctly done. If you use preprinted cartons with sections to be checked to show product type, make sure they are sized and located so the workers can mark them properly. If not, this can cause serious problems farther along in the distribution chain. Are the liners properly folded? Another packaging problem is improperly sized packages. Boxes that are too small usually lead to product damage when the workers try to put five pounds of fish in a four-pound box. On the other hand, too large a container allows product to shift and break.

AUDIT YOUR QUALITY CONTROL PROGRAM

When the quality control program is in operation, it is critical to conduct routine audits. They tell you if the checks are appropriate for the attributes you want to monitor. Don't he afraid to drop a check or move it to a different point in the process if it is not productive.

The most difficult part of making a quality assurance program work is the human element. Be aware of it at all times. Whenever you conduct an audit, it is important to avoid an atmosphere of blame. Talk about problems and solutions, not individuals. Concentrate on preventing problems, not assigning responsibility for past faults.

QUALITY ASSURANCE IS AN ONGOING, EVOLVING PROCESS

Sometimes it seems that the only constant in business is change. We are in an era of global markets and global suppliers. In the past, your competition was the plant across the river. Now it is just as likely to be the plant across the ocean. This is especially true for value-added products. The Pacific Northwest and Alaska are uniquely situated in the center of vast fisheries resources. The three states of Washington, Oregon, and Alaska account for well over one-half of all the fishery products harvested in the United States. Unfortunately, this abundance has lead to our complacency. We have assumed we could always pass on the costs of our operation to the consumer. If they didn't like it they could try to find it elsewhere or cheaper. That is exactly what has happened. Salmon is farmed in Norway, Scotland, the United States, Canada, and Chile. Ring crab, canned salmon, halibut, and whitefish are coming from Russia.

We are no longer the only game in town, and to be honest, when compared to farmed fish, we also are not the best game in town. The only thing left open for us is to be the

smartest game in town. Farmed fish may be the Mercedes of the industry, but remember, not everyone can afford or even wants a Mercedes. The Japanese built their automobile industry making economy cars. However, they made the most dependable, the most consistent, the best economy cars around.

The point of all this is that you have the resources; now you must maximize your return from them. Do this by communicating with your customers continuously: find out what they need and how they need it. Ask what other processors are doing. Keep a formal record of any complaints you receive, act on them, and let the customer know what you are doing. Don't be afraid to let the customer talk directly to the plant quality control and production managers. Communication rarely improves when it's filtered through several different individuals.

Ask the users if there are any changes or variations in product form, pack style, package size, or package construction that would be more useful to them. Work with them to develop the new products.

A trap that members of the seafood industry often fall into is surveying the converted. Too often we ask the wrong people what we should do. Don't talk only to seafood traders. When you travel, step at a fish market or the seafood section of a supermarket. Listen to what the shoppers are saying; talk to the clerks behind the counter. Find out what the actual consumer really thinks.

When you have talked to the buyers, the customers, and the people on the street and have developed records of customer complaints, incorporate that information into your quality assurance plan. Compare the problems you are checking for against the problems the buyers are finding, and then change your processing procedures to prevent the problems. Where necessary change the quality control checks to monitor your performance in these new areas. Quality problems may involve items such as billing errors and shipping errors. They must be addressed, they can't be ignored simply because they don't happen on the processing floor. A series of these types of errors can cost you customers as quickly as bad product. The quality assurance system allows the plant to identify problems of this kind.

KNOW YOUR COMPETITORS

Successful industries continually check samples of their competitors. Check the markets, talk to your brokers, and get samples. Do comparison cuttings. Note competitors' strong points; don't just look for areas where they are substandard. You'll learn a lot more that way.

REGULATORY AGENCIES

The best way to avoid problems with regulatory agencies is to consider them customers, with specific requirements. If you try to understand their goals and design your quality assurance program to include their concerns along with those of your paying customers, you should not have any serious problems. Keep current with their activities through your trade associations, university extension services, and trade publications. Be aware that scientific tests are becoming more sophisticated all the time and people are becoming aware of problems they could not identify in the past. For example when I studied microbiology, *E. coli* was an indicator organism. It wasn't anything to worry about in itself, but because it indicated potential fecal contamination, you tried to minimize the counts. That is not the way *E. coli* is treated today, as Jack-in-the-Box well knows.

A new requirement instituted by a regulatory agency should be treated in the manner described above and the quality assurance program reviewed to see if it should be modified to address the new concerns.

SUMMARY

To summarize, a good quality assurance program allows you to maximize your profits by producing the best quality product for the least cost.

I have spent over 20 years in the seafood industry developing and implementing seafood quality assurance programs. I have faced many challenging problems, including two botulism recalls, *Listeria* concerns, and a canned tuna recall, and I have worked successfully to find the solutions that would satisfy the regulators, the customers, and the company management.

As independent consultants, PhF Specialists can offer you insider's knowledge with an outsider's objectivity. A company such as ours can assist you in matters ranging from establishing a HACCP program to optimizing your quality assurance program economically.

QUALITY ASSURANCE: INTERNAL AND EXTERNAL ORGANIZATIONAL REQUIREMENTS

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At the last Salon International De L'Alimentation (SIAL), visitors were treated to this delicacy: Arctic char fillets. And how were they prepared? They had been marinated in honey, with chestnut topping-all bathed in cognac. Who is the consumer to resist such a presentation?

Of course, some will object to the alcohol for religious or health reasons. And some will object to the sauces. But that is not the point. These are some of the reasons entrepreneurs search for market niches. No one can be everything to anyone. The point is, each entrepreneur must define quality.

THE DEFINITION OF QUALITY

Each entrepreneur must define quality. This is not an abstract operation. It is a very concrete one. Many factors must be taken into account: the market, the competition, the technical requirements, the human possibilities, the financial limitations. In our experimental work, Louis Ronsivalli and I took the U.S. grade A as the standard that the seafood industry ought to achieve.

That is the first strategic decision that the entrepreneur must take. This decision will determine all the others. Once the standard of quality is determined-and the standard ought to be determined as objectively as possible - all other decisions will logically follow. The standard of quality to be attained is the goal to be reached. Nothing less than that can be accepted. Nothing less than that will determine the success of the enterprise. Below or beyond that there is only failure. All resources must be marshaled to achieve that goal.

THE STRATEGIC PLAN: INTERNAL ORGANIZATIONAL REQUIREMENTS

It takes a strategic plan to organize resources. The plan ought to be all encompassing. It must list all resources and direct them to the desired end. The resources comprise the physical, technical, financial, and human resources at one's disposal.

The Physical Resources

No physical resources, no marketable product. This axiom appears to be especially relevant in the seafood industry these days. And of course, there is a defeatist school of thought that accepts the "reality" as is. One cannot fight Mother Nature, it is said. If the resources are not there, nothing can be done.

Another school of thought, however, looks at the resources objectively - not as cod, flounder, or whiting, but as seafood protein. The old saying applies: All is in the eyes of the beholder. This is not a psychological trick. The search for proper definitions can be elevated to the rank of scientific investigation. The result of these different definitions is astounding. If one searches for cod, one is met with scarcity. If one searches for seafood protein, one is met with superabundance.

Where is the difference?

The best way to describe the difference, perhaps, is to keep in mind the difference between the part and the whole. Cod is the part, biomass is the whole.

When one considers the biomass of the lakes and the oceans, scarcity is no longer a factor. Defeatism disappears. Entrepreneurship thrives again. The issue then becomes this: what can be done with the biomass? One school of thought approaches the solution from the point of view of changing the market in the long run. Another school of thought approaches the solution from the point of view of working with the existing market. The goal is the same; the means are different.

The first school of thought designs strategies around the marketability of mackerel and herring through school lunch programs and the Army. The other school of thought designs strategies around the transformation of the biomass into readily acceptable products: it wants to transform the underutilized portion of the biomass, from krill to mackerel and herring, into food pellets for salmon grown in fish farms, for instance, and wants to bring salmon to the market.

The strategies of these two schools of thought are not mutually exclusive. the size of

the biomass is such that both goals can be pursued at once. And if they are both successfully pursued, they will both reap an added benefit. The clarification of this issue starts with the question, Who does the overfishing of traditional seafood species? One school of thought says that it is fishers-and lately sportsfishers-who do the overfishing. Another school of thought, marshaling scientific theories as well as statistical evidence to support its viewpoint, says that overfishing is done by the natural predators of the traditional species.

Since the predators are, among others, the mackerel and the herring, catching them and sending them to market whether through a school lunch program or via salmon, would reduce the pressure on the traditional species that is applied both by fishers and predators.

The Technical Resources

Assisted by the technologist, one should let one's imagination run wild. It seems absurd, but that is what technologists do. They let their imagination run wild - in a controlled and systematic fashion. The combination of natural resources, systematic analysis, and imagination has traditionally been explosive. One never knows in advance what the results will be.

For the design of the quality assurance program, Louis Ronsivalli and his assistants took into account all the technical findings that had been accumulated over the years by the Gloucester Laboratory of the National Marine Fisheries Service and many other laboratories all over the world. Since seafood is a perishable commodity, the most important of these findings concerned the time limitations that determine how long seafood can be maintained in **a U.S.** grade A condition. That limitation determined all the technical requirements that had to be met to assure the maintenance of the highest quality standard for its most extended duration. Time, temperature, and sanitation were found to be the most decisive factors. But there were many others. Handling at each stage of the distribution chain was a factor; and so were packaging and transportation. These factors are innumerable, but they are well documented.

Rather than discuss these issues in this context, it might be more useful to touch upon one policy implication of our work - an implication that is sufficiently described in Gorga and Ronsivalli 1988, chapters 3, 12, and 13. Considering the low (concentrated) costs and the potentially large (diffused) benefits, it is generally appropriate for the government to assist in the R&D process. A successful R&D effort functions as an insurance that the project is indeed financially viable.

The Financial Resources

As we shall see in a separate paper, financial resources vary from internal to external resources. But in nearly all cases, quality assurance plays a pivotal role.

The Human Resources

Arguably the best comment ever encountered in the field of human resources was made by an elder statesman of the fisheries industry, Mr. Frank Foley. Mr. Foley (1981) said, "Quality fish, quality people." One cannot have the one without the other.

The field is vast and the literature burgeoning. Perhaps the two best sources are Crosby 1979 and Covey 1989. But let us not be deceived or try to deceive others by this train of thought. Unless two essential conditions are respected, all efforts in the field of human resources are vain. The first condition is what all the religions insist upon. People must respect each other. True respect is a complex phenomenon - it runs the gamut from appreciation of the other person to acceptance of his or her limitations to true empowerment. When one enters this sphere of observation, one goes beyond status: the other person can be either the boss or the worker.

The other essential condition is financial reward. Talk can indeed be cheap. Deeds count. Financial reward is essential; after all, as even Adam Smith (1776, p. 275) well knew, "It is better . . . to play for nothing, than to work for nothing." Respect with financial reward - that is the winning combination.

That is why employee stock ownership plans (ESOPs) (when properly implemented) are such powerful instruments. They are the platform on which human, legal, and financial requirements can fairly be weighed.

The Implementation Methodology

Marshaling all the resources at its disposal into a coherent plan of action is what each firm must do. Next is to implement the plan. All this is just like a relay race. The baton-the product of the highest possible quality that the firm can produce - is passed down the line. Is one's best effort indispensable to the ultimate

success of the enterprise? Of course, it is. Is it sufficient, however? The answer is no.

It is the entire team that either wins or loses. Quality control is not enough. What is required is quality assurance.

What is the difference between the two?

Quality control is an individualistic, solo, prima donna performance; quality assurance is a communitarian, service-oriented, team effort. Quality control is an inter-firm affair; quality assurance is an intrafirm affair. One concerns one firm at a time; the other the industry as a whole. One is concerned with the parts of the system; the other with the system as a whole.

QUALITY ASSURANCE

Quality assurance, a seemingly unknown discipline, is as complex as the much better known discipline of quality control. Louis J. Ronsivalli and I explored many of its features in a book we wrote on the topic. Many other aspects still need to be investigated. In our book, we reduced the whole of quality assurance to the recommendation that the industry follow two rules (1988, p. 95):

1. Make sure that the seafood entering the system has high enough reserve quality to last until the moment of consumption.
2. Handle the product in such a way as to minimize the loss of quality.

Throughout the book we reminded the practitioner of quality assurance that it is not enough that fish are of high quality when they are landed in port, leave the processing plant, reach the retail counter, or are purchased by the consumer.

It is when seafood is consumed that its level of quality must be high.

The Components of a Quality Assurance Program

In our book we explored quite a few of the components of a quality assurance program. We paid attention especially to the pledge of quality assurance, sanitation, product safety, quality control, strict adherence to a timetable, separation of the catch at landing, inspection, grade labeling, planning, and coordination. In the remainder of this paper, I would like to enlarge upon the topic of coordination and treat it under the more general heading of organization.

THE STRATEGIC PLAN:EXTERNAL ORGANIZATIONAL REQUIREMENTS

Industry knows three main forms of external organization: total decentralization, hybrid forms that fall between total decentralization and total integration, and total integration. After reviewing the advantages and disadvantages of each form, we will see that it is worthwhile to examine the merits of a fourth form: functional integration.

Total Decentralization

Decentralization offers many advantages. Primary among them are flexibility and independence. They are both essential, especially today when nearly every industry is in a state of deep transition. But flexibility and independence are not supreme values. They must be subordinated to the goal of quality assurance, and quality assurance requires coordination of efforts. That is the order that must be brought to the industry if it wants to achieve its goal; otherwise, my father's dictum prevails: Where there is no order there is disorder." Hobbes put it in starker terms: in a society where there is no order, "Homo homini lupus." That is, dog eats dog; every one is against everyone else.

Hybrid Forms

As soon as one mentions coordination of efforts, of course, one abandons the pure form of decentralization and admits to the necessity of some form of control that is short of total subordination. One enters the field of trade associations and marketing agreements, for instance. It is within these hybrid forms that the best businessmen operate. They establish their own form of cooperation and subtle control. For instance, Steve Connolly, with establishments in Boston and Gloucester, Massachusetts, and Mike Foley, with establishments in Boston and New Bedford, Massachusetts, not only maintain close relations with the fishers but are always ready to share their knowledge and expertise, whether formally in training settings - respectively designated as the Steve Connolly Seafood Institute and the Foley School of Fish - or informally with the retailer. This type of coordination is often the result of the will and the ability of only one person. With the disappearance of this catalytic element, the organization of the industry tends to revert to total decentralization or is forced into total integration.

Total Integration

The integration that concerns the seafood industry is mainly vertical integration. The American model proceeds from the top down: the financial and marketing operation tends to extend total control over all the segments of the industry, at least from fishing boats to production lines. The Icelandic model proceeds from the bottom up: it is the producers who own and control the overall marketing organization. An interesting variety of total integration is the McDonald model: either the standards of quality are strictly adhered to by all members of the industry, or McDonald Corporation will not buy the product. General Mills covers the entire spectrum. For its Red Lobster restaurants, it does not only dictate the quality standards of the seafood it buys; it also owns fishing vessels and processing plants. In these forms of organization order and discipline reign, but nearly all members of the organization are subjected to total loss of independence and control over the operations they perform.

Clearly, each form of organization imposes its own forms of control and its own sanctions whenever the necessary standards of cooperation are not adhered to. Decentralization carries with it the sanction of total extinction of the firm; hybrid forms mainly carry with them expressions of moral disapprobation; and integration loss of job. Clearly, each of these forms of organization offers benefits that are counterbalanced by the existence of deep-seated disadvantages. Is there the possibility of lessening the disadvantages while preserving the advantages? Only one form of industrial organization seems able to achieve this goal. This form might be called functional integration.

Functional Integration

In a functionally integrated industry, activities are organized by function. An analysis of the functions performed by each member of the industry will reveal that some functions are the same throughout the industry. Managing real estate, purchasing hardware, maintaining real estate and equipment, financing, and collecting and analyzing information are some of those functions. Why perform them piecemeal? Why not have them performed systematically and professionally throughout the entire industry? Why not delegate these secondary activities and be left free to perform the primary activities of catching the fish, filleting, transporting, and marketing it?

If the industry adopts the model of functional integration, the separation of functions can be agreed upon by the members of the industry, and the model can become operational either as a whole or through a set of gradual steps. Let us assume that the industry wants to delegate as a first step the function of quality assurance and for this purpose establishes a quality assurance board.

Quality Assurance Board

The board will enforce the quality standards set by the industry; it will not set those standards. Therefore, there will not be any opportunity for the industry to become subservient to the board. Also many other safeguards concerning the selection of the employees of the board as well as control over their salaries can be established to assure the same result. The board must remain an instrument of the will of the industry as a whole.

The Real Estate, Equipment, and Maintenance Board

The same approach can be followed with all issues concerning real estate and equipment. Purchase, sale, and lease of real estate and equipment as well as maintenance of all the hardware, in the final analysis, have very little to do with the preparation of high-quality seafood. Those are tasks that today must be performed by each entrepreneur, but they do take time and attention from the essential tasks at hand. Why not delegate those functions?

The Financing and Information Board

The same is true for all functions concerning financing and information, with two additions. By monitoring and coordinating landings (why let everyone fish the same day and the same hour?) and gathering and analyzing price information (why go after the same species at the same time?), in the long run, the board has the opportunity to help establish some form of quantity assurance as well as price stabilization.

Some Common Features of These Functions

There are some features that all these functions share, They are all highly specialized functions whose mastery cannot be acquired overnight; the details of such functions are also liable to change abruptly and drastically over time. Finally, they are functions whose length

of performance varies in nearly direct relation to the size of the firm. Small firms perform these functions only intermittently; large firms perform them on a nearly continuous basis. The separation of intermittent functions from day-to-day continuous functions is an eminently reasonable operation.

Dominating the issue is of course the question of costs: how much does an inopportune interruption to take care of any of those issues cost? How much duplication of efforts is necessary when the industry as a whole is taken into account? How much does the prompt and efficient treatment of any such issue financially benefit the firm?

A Likely Result: a Merging of Boards

If the boards become too numerous and too active, it might make sense to consider the possibility of merging the boards and letting them operate as one coherent entity. Thus, the end of this logical progression of events in the implementation process might be found in this condition: the organization of a supercorporation (a super-ESOP?) that will legally own all the hardware and in turn be owned by all members of the industry in accordance with their initial contribution of values.

Each individual firm will then lease those facilities it needs and attend to the primary care of purchasing, handling, and distributing seafood of the highest possible quality.

Shopping malls are mostly organized along these lines. They let retailers be independent retailers - free of the task of performing such extraneous functions as developing the mall, building the facilities, and maintaining them. The present model goes further: the fishers, processors, and retailers share in the ownership of the physical facilities. In essence, the functional integration model isolates management functions and renders them fully independent; it also unifies ownership rights in shared physical facilities and renders them fully efficient.

The integration of functions might cover either part or the entire spectrum of required activities from fishing boats to retailing facilities-certainly, the supercorporation might want to own retail shops or lease counter space within established supermarkets. All hardware might not only be more effectively maintained but also be more efficiently used. fishing boats - not unlike airplanes - could be serviced and then immediately used on a turnaround basis. Why are they allowed to sit and wait for the crew to rest? As for safety, lives would be entrusted, not to the previous crew, but to a thoroughly professional maintenance crew. Processing facilities and equipment could then be organized on the basis of species rather than processor specialization.

The Limits of the Organization

It is hard to predict the entire development of events, but it is logical to set up the limits to the organization from the outset. At this stage, one can envision only three limits. One is trust; the second is geography; and the last is the law.

Trust

The entire development must start with a high degree of trust in the other fellow. Only if and when two people trust each other can they enter upon the road to this type of organization, always keeping in mind that trust, like most other things, is refined through use. The goal is to be all inclusive, but there is no way of making the organization work if an applicant has not gained at least a minimum amount of trust from the rest of the industry. Participation is not a right, but a privilege.

Geography

The second major limitation is geography. Technical developments today tend to free us from the limitations of space, thus allowing any organization to grow to a greater size than at any time in the past. But technology has its own limits, and the major limit is the set of human relationships in which the organization must grow. If people do not grow with the organization, if the organization stunts their growth, that is probably a sign that the organization has grown too large. The resulting efficiency level will tell the tale.

The Law

Antitrust laws have been promulgated for good reasons. Some of the effects of those laws might not have been as beneficent as the intent of the framers of those laws would lead one to expect. But the reasons behind those laws are valid. Such reasons must be respected by any form of functional integration. If that is done, it will be discovered that the law - as an expression of a caring and efficient society - does not restrict anyone. It simply frees us all, even those of us who are prone to excesses.

CONCLUDING COMMENTS

The assurance of quality will not be delivered to the consumer unless there is a concerted effort to achieve that goal - not only by each firm but by all firms in the industry. That is the major difference between quality control and quality assurance. That is also the major difference between internal and external organizational requirements to assure that only products of the highest possible quality reach the consumer. Such an effort requires a high degree of coordination among different firms. Hence, it is essential to have a responsive internal and external organization. Externally, the seafood industry - no more than other industries - oscillates between two extreme poles. There is either extreme decentralization or extreme centralization. Both forms of organization offer considerable advantages. But they also have considerable innate disadvantages. Hybrid forms of organization tend to increase the level of negatives without necessarily raising the level of positives. Thus, a fourth form of organization suggests itself: functional integration. Functional integration has the potential of yielding maximum flexibility coupled with maximum independence.

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Measuring and Controlling Seafood Quality

HOW ARCTIC ALASKA MEASURES AND MAINTAINS WHITING/SEAFOOD QUALITY

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Arctic Alaska Fisheries Corporation started in about 1985 with just a couple of boats, and Francis Miller, our founder, increased that number to a pretty large outfit. Recently, we were purchased by Tyson Foods out of Springdale, Arkansas. In addition to the Louis Kemp Seafoods Group, we have all now been placed in what they call the Seafood Division. It's been quite different for us, from the past, when we did business with a lot of the old crab fishermen, to the situation now, when a lot of people speak funny and talk about chickens most of the time. But it's really been an experience in terms of getting us to think about our next level of growth. Tyson does about $4 billion in sales a year. The seafood side is about $300 million annually. Currently we have over 30 catcher processors and six shore plants. Two of those plants, one in Newport and one in Canada, are specifically associated with the processing of Pacific whiting. We also have an aquaculture facility in Idaho where we raise talapia. We hope to see more growth in that area.

I want to concentrate my remarks on just a couple of areas. One is identifying the orientation of the customer. That is probably the main focal point Tison has brought into our business. Meshing production and marketing is difficult. Most of us come from a production-driven industry that is highly regulated by the government. This determines many of our objectives as a company. Then we say "O.K., sales and marketing people, do what you can - here's the lump of fish that we have been given for this specific period of time." On top of this, we say that we have to exceed the customer's expectations. Often we have to determine what those expectations are. I think that to be able to determine what those customer expectations are, we need to further identify who those customers are, whether they are government regulators or buyers, and what aspect of the market they represent. In our business, we've categorized most customers as food service, club stores, retail, or export. Each of those segments of the market has specific needs and desires that must be addressed.

Hazard analysis and critical control points (HACCP), total quality management (TQM), and good manufacturing practices show us that we are evolving. In our company we have a wide range of ships, from small catcher processors that have crews of fewer than a dozen people who do everything from cooking to swabbing the deck to handling the quality control, to surimi vessels that have very sophisticated laboratories where the crew performs a myriad of tests and evaluations. So all of the tests have to be very specific. One of the messages I get from fishers is that they have to be treated on an individual operational basis. If you go aboard, for example, the Ocean Phoenix - a large factory trawler - you see a different operation from that of a catcher processor that's only a hundred feet long.

A great benefit from HACCP is that in putting together our plans, in recording our data, we become accountable. That's where we are able to provide the necessary incentive to have people do their job properly. TQM, the buzz work in the industry, is what I call motivation and attitude. And through good manufacturing practices, we provide our operations department with continuous guidelines. These three aspects have to be the driving force and the direction of the quality assurance program.

By identifying product safety and line control, we are starting to address some of the food safety issues of the 1990s. We need to identify the quality of our products in a quantifiable way. That can be done through microbiological testing. We also need a strong audit program. We have a field quality assurance staff that operates out of Alaska in a couple of different ports; in port, they go through an auditing process with on-board quality assurance people. That audit provides immediate, constructive feedback to the processors, right on the grounds. Furthermore, through our audit system, we have a Seattle laboratory that generates and analyzes additional data that we make available to our customers. Through our audit system, we are continually improving what we are doing at sea. It is a long-term process. When we first started, it was tough to get

even little things done in terms of quality assurance programs.

We also have been very lucky, through Tyson's acquisition of our company, to become a buyer of seafood. As a buyer, I get to wear a different hat sometimes. I get to see what is available on the market. One of the things Tyson has done in terms of quality assurance is to generate a preferred supplier list. Tyson ranks suppliers on three levels: deferred inspection, re-inspection, and probationary trial. The company lets its customers know where they stand on this preferred supplier list. They work very closely with customers to give them all the necessary feedback and tools so that they can approach preferred supplier status. That, of course, rolls into sales and price and the other attributes associated with being able to have that type of relationship.

I want to make a point about training. In the past year our program has had an in-house certification program. As an industry, we need to identify the specific needs of individual vessels and individual plants. There needs to be a certification process so that individual vessels and plants can meet company requirements - knowing how to inspect, what to inspect, and how to record and report that information. It is important to have inventory control and be able to identify your product through distribution. You need an adequate recall program to actually identify your product in a meaningful way all the way through the system. Our company is in a fully integrated role now because we are a catcher-processor. We provide value to add to our product, and then that product goes on to those customers I mentioned in food service, club stores, retail, or export markets. Tracking the inventory provides us with a tremendous tool as a processor. The buyer can come in and work right with the vessel, providing us with data to improve the system. This is what integration of data is about: providing the data for all the various levels of processing and fine tuning what you're actually able to produce to a certain specification. It's finding your weak spots and then fixing them. I think quality assurance or quality control is an integral part of being able to make those determinations.

One of the big things we learn in the corporate gridlock of a big company is that you have to be able to operate successfully in a team environment and have cross-functional groups that participate in quality assurance. I wish I had done more of this early on with the organizations I was in, especially when they were smaller.

The following areas are critical to a good quality assurance program for any seafood company.

Sales and Marketing

The sales and marketing effort is directed at the customers. Working with customers to identify their needs is the key force that drives sales and marketing. It gets back to the conflict between production-driven and market-driven efforts. You can't necessarily have one without the other; I don't think that you can be just market driven, especially the way our fish are regulated in this industry.

Operations

Operations are what I call the mechanical ability to do the job. You need to become familiar enough with our operations to know that our facilities have the proper tools to make the quality of product we expect. If you had a hand cutting line instead of the fancy 182 automatic cutters, it would be tough to make a skinless, boneless fillet at 60,000 tons a day or 60,000 pounds a day or whatever the production goals your company has set. Through R&D, we now develop specifications. Tyson provides quality assurance tailored to a particular customer. Tyson may assign an individual to work with a Sam's or with a McDonald's and organize technical people and buyers into a working team to identify what the buyer's requirements are. Bob Joseph and his group at Red Lobster are very talented in that area; they have the experience necessary to work with the processors to identify what their needs are going to be.

To be able to have the technical services people aboard the operations gives you an incredible advantage when it comes to getting your operations up to speed and up to customer specifications quickly.

Personnel

Personnel is an area that all of us are working in. Human resources departments were developed partly to give us a consistent work force, to help us get into the brain of the processors. Sometimes I wonder about this when I'm out on the boat and we're listening to Twisted Sister and packing fillets. I have been amazed how you can communicate with four-letter words. I don't say that in any negative

light, because that's just the environment that we're in. From a personnel standpoint, we need to train and maintain those people; we need to educate them to the point where they become very familiar with the processes. Some of those people I would rather have packing and processing my fish from a quality standpoint than anybody because they know it the best. So you have to figure out ways to keep hold of them. That's really a human resource issue, but it has a profound effect on quality assurance.

Procurement

We are also procurers of product, as I mentioned earlier. From that aspect, we need to be able to know what level of quality and value is available. Regulators are included because they are customers as well. Even though we don't necessarily have to have our systems meet their program, we need to integrate the regulations so that we can operate effectively and reach our common goal. We often fall into the fallacy that we're going to have to reorganize and change everything to meet the regulations; in reality, I don't think that is necessarily the case with many of our programs.

Government Affairs

How would it be if we had a season when we could be given a certain amount of fish and we had all year to catch it? Or even better, what if we could catch these fish and they weren't spawned out and skinnier than a hot dog? How many times do we enter into these seasons? I would like to challenge all of you, if you have the opportunity, to participate in the councils or with your respective companies and staff. There needs to be more discussion from our end, from the technical end. Why do you try to catch yellow fin sole in May? Wby are we out here catching whiting on April 15 when the fish are in pretty poor condition? I know that some of this fishing activity revolves around the times that we can actually get the fish grouped together to catch them, but that's pretty minor in terms of management. We have to get the regulators thinking about the marketing and quality assurance aspects of fisheries. We all can have a profound effect on the final quality of our products.

In closing, we need to understand our ability to evolve and change in this quality assurance field. The most successful operations are those that respond most quickly to correct a new market, for example, when we've got to make deep-skinned fillets, cut the loins off of them, and do something to the crab to get them in even weights. Our ability to adjust is the real advantage. For us to develop our quality assurance programs to be able to meet those needs, for us to act as a service organization, for us to have our operations, our sales, and marketing achieve that goal is what it's all about. Then in the end we make money.

SENSORY ANALYSIS APPLICATION TO HARMONIZE EXPERT ASSESSORS OF FISH PRODUCTS

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INTRODUCTION

Seafood is an important commodity in international trade, and the amount being traded is rising steadily. FAO fishery statistics from 1990 show that of the total world catch of over 97 million metric tons, nearly 40 percent is traded internationally by 183 countries. The U.S. and Canada are ranked first and second in value of fish exported (over U.S. $5 billion total).

As product moves across borders, quality and safety are often either officially regulated or must meet common industry standards for that country. Failure to comply with regulations or customary standards can lead to product detention or rejections, which certainly impedes trade. Detention or rejection of product for these reasons means financial losses and further deterioration of product quality. Comparable quality standards will encourage competitiveness in the international market for that product (Weekes 1993), whereas variations in product standards when trading fishery products can act as a nontariff trade barrier between countries (Lupien 1993).

In considering standards for fish products, we must distinguish between government and industry product standards. Government standards may be regulatory, describing specific requirements for minimum quality levels in response to legislative mandates, or may be grade related, describing attributes associated with quality levels. Industry standards may be specific to individual companies, products, or user groups. Government grade standards and industry standards are often more stringent than the regulatory minimum quality levels.

Our aim in this paper is to discuss the role of sensory analysis in the application to fish inspection through our experience in the harmonization of inspectors from their two countries.

Sensory analysis of seafood has always been part of the production process through the application of government - or industry-developed grading systems (York 1990). Sensory analysis is a practical, reliable, and sensitive method for determining seafood quality. In a real sense, fish inspectors are sensory analysts, or assessors, who work as expert evaluators in the application of the trading countries' product standards. In this paper the terms *inspector, analyst,* and *assessor* will be used interchangeably.

In the last few years, there has been a strong movement towards the development of common international standards for products and harmonization of sensory testing criteria. The next step in this process is joint participation in standardized analyst training and calibration to ensure a uniform application of sensory testing for seafood quality.

Quality standards frequently vary among exporting and importing countries (Lupien 1993). One group may have more stringent regulations when it comes to seafood quality. Food standards and food trade were among several topics discussed at an international conference held in Rome in March 1991. The conference stressed the need to accelerate the harmonization of national and international food regulations and identified the training of personnel for inspection and laboratory functions as the cornerstone of the project (Lupien 1993).

In the proceedings of three major conferences on fish quality held since 1968, the topics of fish inspection and product standards have been described in terms of the need for harmonized standards given by representatives of specific countries and information on product standards used by these countries. The most current reports include information on the development of product standards in Codex

Alimentarius and in the EEC. (Kreuzer 1971; Connell 1980; and Kramer and Liston 1987). Little or no information is recorded on the training of the expert assessor who will administer these product standards.

Historically, sensory analysts from different countries, regulatory agencies, and private industry have participated in varying levels of training in sensory inspection of fish products. Joint training, across countries or groups, has not been common practice up to this point. Within each of these groups, the individual assessors have been trained according to the specific product standards that may have varied in stringency and requirements.

Efforts have begun to harmonize standards among countries, both internationally and regionally (Miller 1993). A United States-Canada Committee on Fish and Fishery Products has been established under the 1988 U.S.-Canada Free Trade Agreement (FTA). The three inspection agencies from the two countries were given a l0-year window of time to harmonize regulations and establish equivalent inspection systems.

The committee has various technical working groups, one of which has a subworking group on essential composition and quality, whose aim is to ensure that sound, wholesome product is traded.

Decomposition in fishery products, both a safety and quality issue, continues to be a problem. The development of equitable quality criteria and the application of sensory testing practices to detect decomposition will facilitate trade by reducing product rejections and detention.

Recently, the FTA subworking group recommended that Canada and the U.S. maximize agreement among the analysts on the acceptance or rejection of fish, based on decomposition. Analysts worked toward defining and standardizing the point of decomposition by species or species group, using sensory procedures.

That sensory assessment was an important tool in the measurement of fish quality relative to, product standards was emphasized in a 1986 report on fish inspection in Canada by A.B. Morrison. This report further recommended that the level of sensory training given to fisheries inspectors include university-level training in sensory science as well as training in fishery products and the standards applied to them.

Sensory science can be classified into four categories according to analyst type. Each analyst type functions differently and has specific selection, training, and validation requirements. Different purposes, situations, or desired types of information require the use of different analyst types.

Seafood inspectors fall into the fourth, most highly trained and experienced, category of "expert assessors." Expert assessors evaluate product full time, function independently, and are responsible for their samples. Product experts usually have extensive training and product experience and are often used in quality control and product development.

Because seafood inspectors have extensive product knowledge and experience, they are essentially already trained. Training in specific products has been both as on-the-job training while working with senior inspectors, and as special workshops held to demonstrate quality changes and regulatory action levels of product decomposition for specific products or product groups. Demonstration workshops may provide information that is in conflict with data experiences that sensory assessors have picked up on the job

A more effective approach would be to address inspectors as expert assessors under the guidance of a discussion leader using samples from a full range of quality as a tool to facilitate communication among the analysts. It has been established that through the application of qualitative and quantitative sensory methodology, analysts can be brought into harmonization. This methodology has not been routinely applied to the inspection of fish and fish products.

Experienced analysts from different regulatory agencies can be successfully "harmonized" or "calibrated" by applying established sensory science methodology to joint training workshops. Calibration of analysts was accomplished in a workshop setting where facilities, conditions, and sample preparation procedures were standardized.

MATERIALS AND METHODS

Workshop Format

The harmonization exercise took place over a five-day period beginning with an orientation on the first day, then evaluating three species, one each day, and concluding on the last day with a revisitation of each species to determine

the degree of retention. Nine analysts participated, three from each agency. Samples were presented in sets of 15 with l5-minute rest periods in between. The sets were arranged into three categories, each with a different objective, which were called sessions. The harmonization process for each species consisted of three parts: (1) a demonstration session, (2) a practice session, and (3) a test session. Each session had a different objective.

An orientation session was held the first day to familiarize analysts with each other, the data collection sheet, and the process of sample examination. Analysts were encouraged to ask questions, voice concerns, and make suggestions.

(1) During the demonstration session, samples representing a full range of quality were displayed together in increasing spoilage increments in a single session. Analysts independently examined and rated the samples, in order of increasing spoilage increments, noting terms that best described their sensory perceptions at that quality level.

The demonstration served as a warm-up exercise, helped analysts develop terminology, provided a useful discussion tool in identifying quality characteristics, and anchored end points of quality so that analysts would be more comfortable using the full scale (Rainey 1986).

(2) The objectives of the practice session were to provide product experience, reinforce consensus decisions, and gather terminology. The session format was similar to the demonstration session, except that the samples were blind coded and displayed in a random spoilage order. The discussion leader summarized and discussed results after each sample set with the analysts. After the first day, it was brought up that inspectors felt pressure to hurry through samples so that they were not too physically destroyed by other analysts by the time they examined them. This pressure was alleviated by allowing the analysts to walk through and observe the appearance of all samples before the evaluation procedure. This observation step functioned as a warm-up procedure within each session and was continued in the test sessions. At least three practice sessions took place, emphasizing discussion and reexamination of samples.

(3) The test session was a data-gathering exercise to measure the degree of agreement. Blind-coded samples were examined as in the previous session. Analysts independently examined samples; no discussion was allowed. At least three test sessions took place to allow for adequate data collection.

On the final day, analysts participated in a test session revisiting each species encountered during the week. This reevaluation was used to indicate the amount of retention of harmonized sensory criteria.

Data Collection

The format for data collection was a recording sheet that included the following for each sample:

Sample code - a three-digit, random-number code.
Inspection decision - P (pass) or F (fail).
Sensory scale - an unstructured 10-cm line scale with anchored end points of P (pass) and F (fail) and the midpoint identified.

Data were collected both on the pass-fail decisions and on the unstructured line scale. For the unstructured line scale, numerical values can be assigned to the assessments of overall quality of each sample. In addition, the score sheet provided room for recording terminology.

The Discussion Process and Terminology Development

After independently evaluating samples, the group congregated in a central area for data collection and discussion. To reach group consensus, the discussion leader acted to draw out information from group members, after examination of 15 samples. To do this, the discussion leader recorded and summarized the data in group discussion and then presented it to the group. In this process, the discussion leader recorded the number of failed units per spoilage increment on a flip chart. Each analyst was asked to state his or her decision and any reasons relating to sensory characteristics for that decision. Differences in perceived sensory characteristics were explored through discussion and reexamination of the samples. Commonalities were identified, emphasized, and reinforced.

The discussion process included three steps: development of common terminology (focusing on sensory characteristics), consensus of intensity or levels of these characteristics, and application of this information to the decision process. In other words, when a defect is found, the discussion process must include the following questions: Do all analysts detect the characteristic? What common term or word best

labels the characteristic? Do all agree on the level of intensity? Is the presence of this characteristic grounds for rejection?

Summarization of data provided immediate feedback and motivation and allowed the analysts to see where they were in relation to the group. Discussion focused on each sample, then on the samples as a group. Focus was on the pass-fail cut off point, with particular attention to sensory defects that pulled a sample into the "fail" category. Results from chemical analyses were included in the discussion, for comparison purposes.

Samples

Species were chosen by assigning priority to those products and product forms that represent the largest volume or economic impact to trade between the countries. Samples of cod, flounder, and scallops with a known history, representing a full range of commercially produced product, were examined by the analysts. Samples were analyzed chemically for TVB-N putrescine and cadaverine before the workshop. Results from representative samples were available for the exercise.

All samples were presented to analysts in booths, except for during the demonstration session. During the demonstration session, samples were displayed together to allow analysts to compare samples and view the full range of quality.

RESULTS

Bilateral harmonization exercises have begun between the U.S. and Canada to decrease, as much as possible, any differences that may exist on the application of sensory analysis to detect decomposition in seafood.

A fine-tuning of analysts can be realized, and a harmonized pass-fail point can be established and maintained. This is achieved through the application of established sensory methodology drawing from quantitative analysis (unstructured line scale) and qualitative analysis (descriptive profiling).

Similarities must be realized and communicated through interactive discussion and reexamination of product.

Similarities and common evaluation criteria should be identified through common terminology (Vance Civille and Lawless 1986), levels of intensity, and application. Most similarities and differences surfaced the first day of the exercise, and the analysts were able to carry over the consensus on basic quality criteria to other species.

The application of sensory criteria needs to be clarified. Groups can perceive the same sensory defect but apply the criteria differently to make different regulatory decisions. One group may associate a defect with decomposition while the other group considers the defect objectionable, but not indicative of decomposition. In regulatory standards, any presence of decomposition that is recognizable (distinct and persistent) will cause product to be rejected. If the defect is considered to be objectionable, but not associated with spoilage, then the level of stimulus may have to reach a certain intensity to cause a rejection of that product.

CONCLUSIONS

Governmental agencies and industry alike have experienced, knowledgeable personnel who, through the application of focused discussion and formalized sensory training, can become an extremely objective, accurate, cohesive group of sensory analysts. Through standardized training and monitoring, analysts can uniformly and consistently assess sensory quality characteristics of seafood as they relate to grade level or to decisions to accept or reject product.

Continuation of product workshops using a discussion format will attune inspectors to the application of sensory testing to determine and arrive at consensus on product quality. Product experts can participate in interagency and intraagency workshops to be internationally harmonized and calibrated. These sessions can be regularly scheduled and be product or product group specific. Calibrated experts can rotate among training locations to train other analysts.

Development of sensory testing guidelines and continued participation in joint training for government and industry will increase the agreement and consistency among sensory inspection personnel. Consistency in the application of sensory testing to determine seafood quality will increase constancy in product quality measurements. This will facilitate trade by reducing rejections and detention of product.

FUTURE TRENDS

Internationally, the expert sensory analyst is being acknowledged. The International Organization for Standardization's committee on sensory analysis has a draft document (ISO/CD 8586) that recognizes and establishes

guidelines for sensory assessors. Codex Alimentarius, whose purpose is to protect consumers' health and ensure fair trade practices, is in the process of incorporating sensory evaluation procedures into their standards to clarify the statement in the Codes of Practice for fishery products that "sensory evaluation shall only be performed by those properly trained to do so." At their last meeting, Codex identified "the need to establish a uniform approach to inspection procedures, particularly those involving sensory evaluation." This is to be accomplished by the development of a Code of Practice for Sensory Evaluation of Fish and Fish Products, which is now in the draft stage (Howgate 1992).

It is anticipated that sensory evaluation in international trade will increase in importance. Often, seafood quality does not mean the same thing to people of different countries. Through the application of established sensory science principles to bilateral "harmonization" exercises, it was demonstrated that a fine-tuning, or calibration, of sensory analysts from different governmental agencies can occur. The next step is to create uniformity in the inspection force through standardized analyst training and calibration using internationally harmonized analysts.

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MEASURING AND CONTROLLING SEAFOOD QUALITY IN JAPAN

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INTRODUCTION

It is well known that Japanese people eat raw fish as sashimi. As a result, safety standards for seafood are stricter in Japan than in other countries. In this paper, I will describe how seafood quality is measured and controlled in Japan. I will cover the following subjects:

1. Postmortem changes in fish meat
2. Fish freshness indicators
3. Indicators and methods for determining the freshness of fish
4. Style of raw fish and quality control in Japan

1. POSTMORTEM CHANGES IN FISH MEAT

Within the period of time between the death of a fish and its consumption, a large number of biochemical and physicochemical changes take place. Postmortem change in fish meat can be represented briefly as follows:

catching > rigor mortis > dissolution of rigor mortis autolysis > spoilage

The prerigor state, in which the muscle is soft and pliable, is characterized biochemically by a decrease in adenosine triphosphate (ATP) and creatine phosphate levels as well as an active glycolysis . The stiff, rigid condition of the muscle tissue is known as rigor mortis. Fish generally exhibit a short rigor mortis period starting from 1 to 6 hours after death, with numerous factors determining the duration. Because of the depletion of the oxygen supply to the tissues after the death of a fish, anaerobic metabolism takes over, resulting in the conversion of glycogen to lactic acid. With a fall in ATP and creatine phosphate, actin and myosin gradually associate to form inextensible adomosin (the onset of rigor mortis). The importance of rigor mortis in fish is realized in the fishery industry because, in addition to retarding microbial spoilage, it gives fish a stiffness that is generally recognized as a sign of good quality by consumers.

Following the dissolution of rigor mortis, a gradual tenderization of fish meat occurs, and high-molecular weight compounds such as proteins, lipids, and glycogen gradually degrade into lower-molecular-weight compounds, which can be used more readily by microorganisms. Prolonged storage of fish will soon result in microbial spoilage, decomposition of proteins caused by indigenous enzymes (autolysis), and the development of unpleasant flavors. In live, healthy fish, the muscle tissue is sterile. However, freshly caught fish have considerable numbers of microorganisms on their skin and gill surfaces. Following the death of the fish, the mechanisms involved in the control of microorganisms are no longer functional, and microbial growth presumably occurs with movement into the various tissues throughout the vascular systems.

The above process is shown in figure 1.

2. FISH FRESHNESS INDICATORS

Since the retention of fish freshness is necessary for the production of good-quality products, accurate and rapid determination of freshness is essential for the marine food industry. Many indicators have been proposed for the estimation of freshness.

Organoleptic Indicators

In the organoleptic indicators, fish freshness can be determined subjectively, through sight, smell, taste, and touch. Although these senses provide a rapid way of determining freshness, it is difficult to evaluate fish freshness quantitatively.

Physical Indicators

The hardness of fish meat (Yamanaka et al, 1978), electric resistivity and dielectric ratio of fish meat (Asakawa 1957a; Nagamatsu 1960), viscosity of fish meat exudate (Labarre et al. 1942), and refractive index of fish **eyes (Love** 1954, 1956) have all been used as physical indicators.

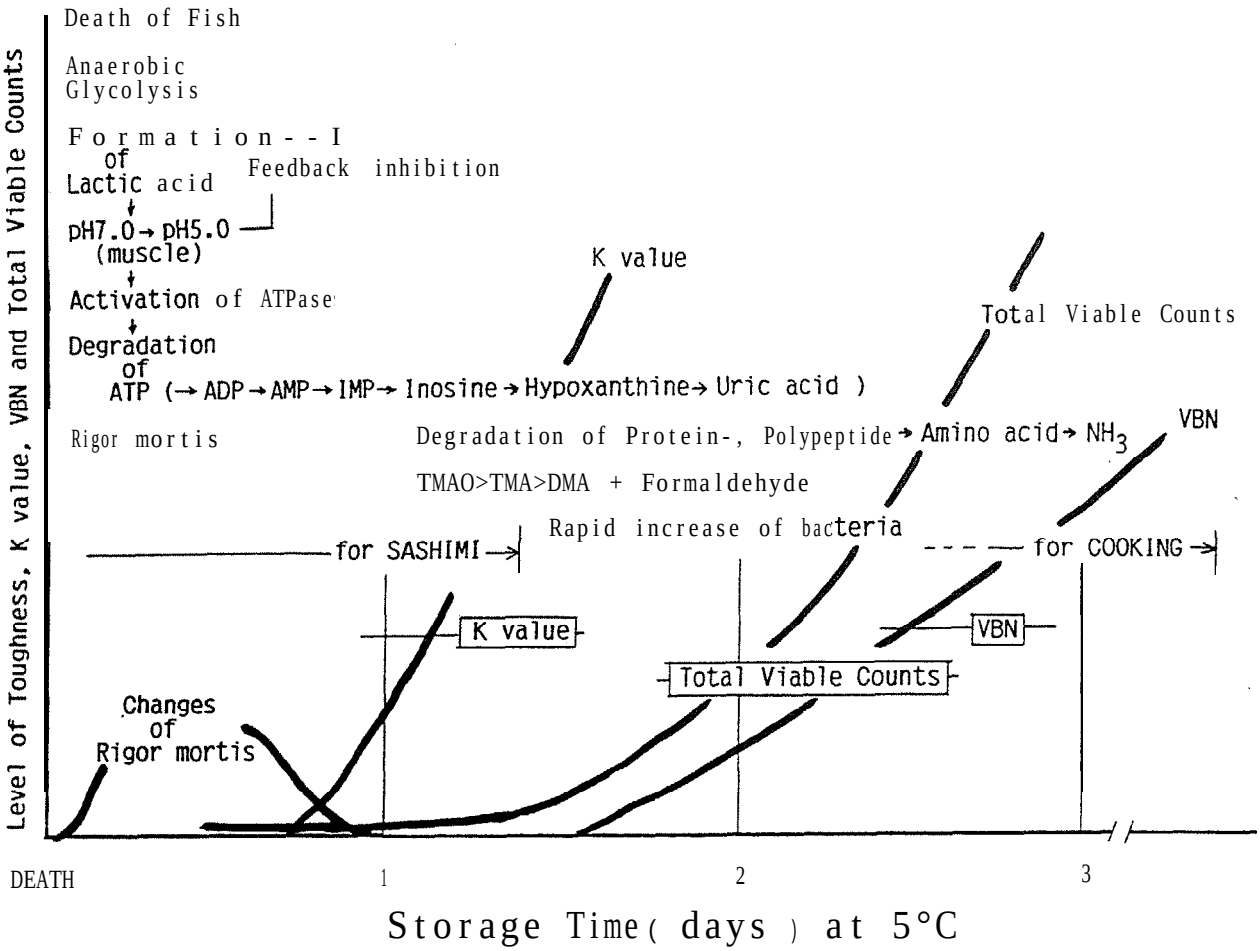

Figure 1. Postmortem changes in fish meat.

Microbiological Indicators

Spoilage is caused by the action of microorganisms, so that the number of living microorganisms correlates with the degree of spoilage (Kimata 1936a, 1936b, 1936c). When fish meat is at the initial stage of spoilage, the number of living cells is around 10^6 cm^{-2} of skin; a strong odor of spoilage will be perceived when this number is 10^7 to 10^8 cm^{-2} To count the number of living cells is complex and time-consuming, so it is not a practical method for estimating fish freshness.

Chemical Indicators

Researchers have proposed a number of chemical indices of fish freshness: volatile basic nitrogen (Tomiyama et al. 1952; Takase 1953; Kawabata et al. 1953a, 1953b); ammonia (Yamamura 1933; Takahashi 1935; Ota et al. 1952, 1954; Tokunaga et al. 1977); amines (**Takahashi** 1935; Tokunaga et al. 1977); volatile acid (Suzuki 1953; Asakawa 1953, 1954 1957b, 1959); pH (Yamamura 1936; Kawabata et al. 1952; Yamamoto et al. 1953; Miyake et al. 1955); buffering capacity of muscle (Suyama et al. 1958); and adenosine triphosphate (ATP) and related compounds (Saito 1961; Ehira et al. 1966; Fuji et al. 1966; Ehira et al. 1969).

According to detailed investigations of phosphorylation in animal muscles (Saito 1956, 1961; Jones et al. 1964, 1965; Burt 1968; Uchiyama 1970; Jahnes et al. 1976; Numata et al. 1981; Yamada et al. 1981; Lee et al. 1982), the decomposition of ATP in the fish meat sets in after the death of fish, and adenosine disphosphate (ADP), adenosine monophosphate (AMP), and related compounds are generated subsequently according to the sequence shown in figure 1. In most cases the rate-determining step is from inosine to hypoxanthine or from hypoxanthine to uric acid, depending on the species of fish, and consequently inosine or hypoxanthine is accumulated with increased

storage time. The total number of ATP-related compounds is usually constant, so the ratio of inosine + hypoxanthine to the total number is defined as the K value (Arai et al. 1961).

$$K\ value\ (\%) = \frac{inosine + hypoxanthine}{ATP+ADP+AMP+IMP+inosine+hypoxanthine} \times 100$$

K value is the most reliable indicator for fish to be eaten or not to be eaten as sashimi, that is, raw fish, in Japan. In case of a K value below 20%, it is possible to eat the fish meat as sashimi. With K value of up to 40%, it is possible to eat the fish by cooking. Of course, above 40%, it should not be eaten.

These values fluctuate widely with the species tested, and the procedures involved are usually tedious and time-consuming. Moreover, postmortem change in fish meat is fairly complicated, as noted above. Therefore, it is difficult to determine fish freshness accurately by the single indicators proposed.

A more accurate indicator of fish freshness is the overall and enzymatic reaction attributed to the changes in fish freshness, because various reactions taking place in fish meat, such as glycolysis, ATP degradation, denaturation and degradation of proteins, and oxidation of lipids, proceed at individual reaction rates (Watanabe et al. 1987).

The solubility of protein in salt solution and ATPase activity of myofibrillar protein (myosin) are used as indicators for denaturation of the protein. These indicators are very important in surimi manufacturing.

3. INDICATORS AND METHODS FOR DETERMINING FISH FRESHNESS IN JAPAN

The methods used in Japan for determining fish freshness are as follows. (The asterisks [*] indicate products on the market.)

a. Judgment from a single component.
VBN (TMA, NH3) - microdiffusion method (Conway)*
Polyamines (histamine, cadaverine, putrescine) - HPLC*
K value
- column method (ion exchange resin)*
- enzymatic method--Oriental electric Co. Ltd.*
- HPLC method*
- enzyme sensor - New Japan Radio Co. Ltd.*
- test paper - EAC Corp.*

b. All-round judgment
pH (ß-buffer capacity)
viable cell counts ——— Biosensor
nondestructive biological sensor-electric resistivity - Torrymeter*
color, order, elasticity - organoleptic

c. Indicators for processing (especially, surimi)
water-holding capacity
Ca^{2+}-ATPase of myosin

d. Determination of K value with biosensor (Okuma et al. 1992)

A continuous system for determining fish freshness with double enzyme reactors was developed and applied to the determination of the freshness indicator {K = [HxR + Hx] / (IMP + HxR + Hx] x 100} in many types of fish, where IMP, HxR, and Hx are inosine monophosphate, inosine, and hypoxanthine, respectively. The system was prepared from two combinations of oxygen electrodes and reactors. One reactor for the determination of the total amount of HxR and Hx was packed with nucleoside phosphorylase (NP) and xanthine oxidase (XOD), immobilized simultaneously on chitosan porous beads. Similarly, another reactor for IMP, HxR, and Hx was packed with 5-nucleotidase (NT), NP and XOD, immobilized simultaneously on chitosan beads. The system was prepared from two combinations of oxygen electrodes and reactors. One assay could be completed within five minutes. The system for determining fish freshness was reproducible within 2.1% (n=30). The immobilized enzymes were sufficiently stable for at least seven months at 4° C. More than 200 samples could be analyzed in about one month by using these enzyme reactors. The results for fish meat (13 types) correlated satisfactorily with those obtained by liquid chromatography (r = 0.989, n = 253) or ion exchange resin column chromatography (r = 0.973, n = 50). These results suggest that the proposed sensor system provides a simple, rapid, and economical method for determining fish freshness (ki).

Figure 2 and figure 3 show the schematic diagram of the reactor system and the results obtained by the proposed sensor system, respectively. Figure 4 shows an article on the market: BIO FRESH.

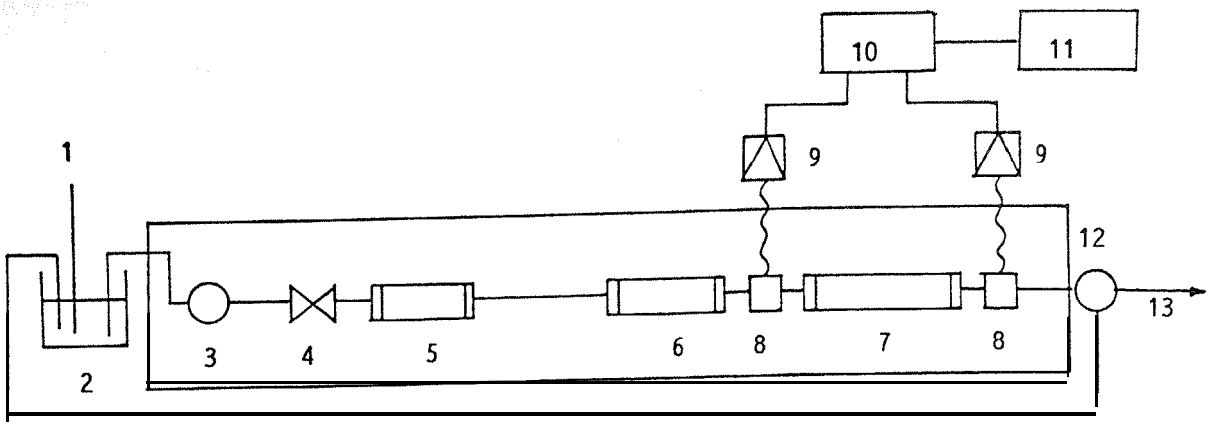

Figure 2. Schematic **diagram** *of the reactor system: 1. air, 2. buffer tank, 3. peristaltic pump, 4. injection port, 5. precolumn, 6. enzyme column: (co-immobilized nucleoside phosphorylase and xanthine oxidase); (co-immobilized 5'-nucleotidase, nucleoside phosphorylase and xanthine oxidase), 8. oxygen probe, 9.A/D converter, 10. computer, 11. recorder, 12. valve, 13. waste*

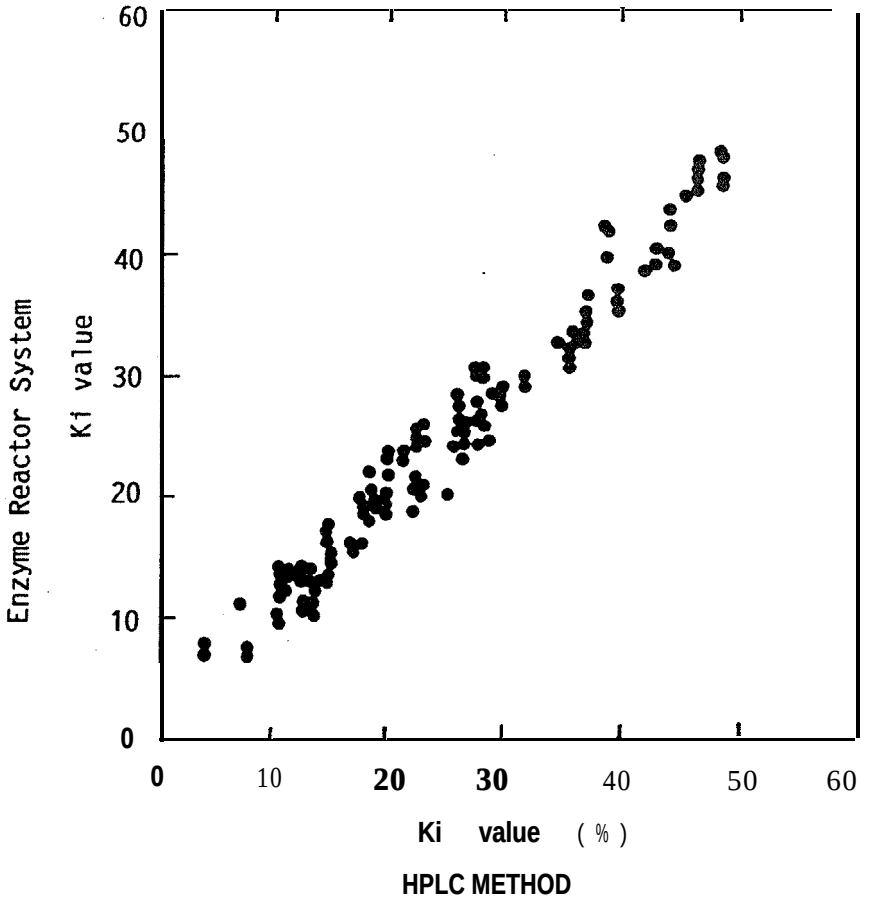

Figure 3. Correlation between K1 value of fish muscle determined by the enzyme reactor system and by the conventional LC method.

4. STYLE OF RAW FISH AND QUALITY CONTROL IN JAPAN

Figure 5 is an aqua-farm in Kagoshima Bay in Japan. Now 1.2 million tons of fish are cultivated in Japan (1989). This is equivalent to one-tenth of the total fish catch per year in Japan and is worth 5 billion dollars.

Fish meat after instant death can be eaten raw as sashimi. Flounder and sea bream are transported to an eating house as live fish. Flounder is eaten before rigor mortis, sea bream during rigor mortis, tuna and other fishes after rigor mortis.

Unfrozen and frozen fishes are used for sashimi or cooking. Of course, these fishes are used as raw materials for canned food and other fish products.

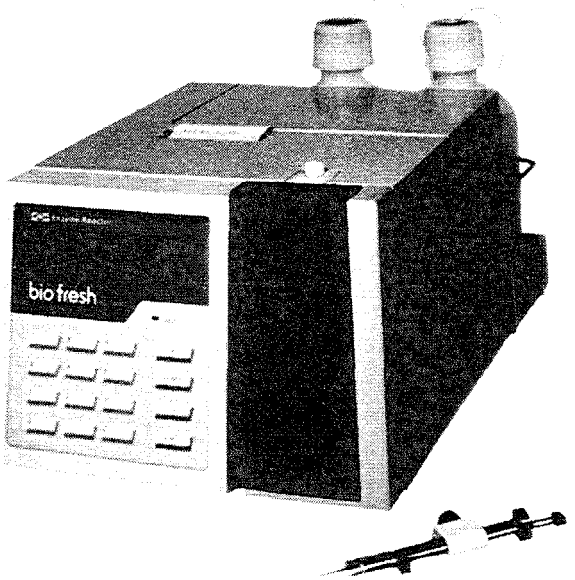

Figure 4. Fish freshness sensor "BIO FRESH."

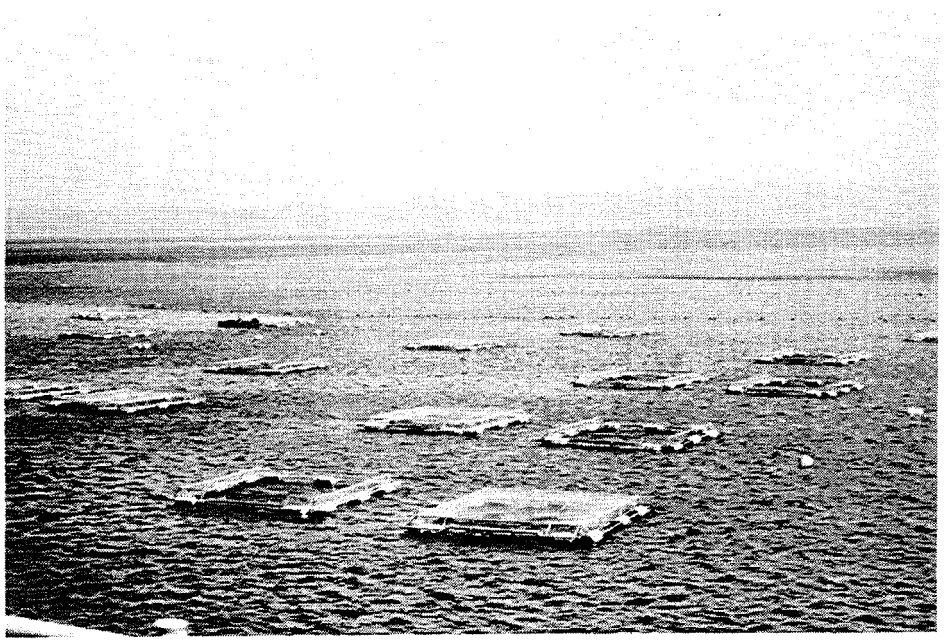

Figure 5. Sea farm in Kagoshima bay in Japan.

Figure 6 is a container for transporting unfrozen fish. After being caught, fish are stored at 0° C in the container and transported to local retail shops as they are. This container is still in the experimental stage.

Figure 7 is the frozen tuna at Tsukizi market. Buyers examine the quality of tuna from the cross section of tail portion. This is the actual determination of fish quality in Japan.

Figure 6. Container for transporting nonfrozen fish

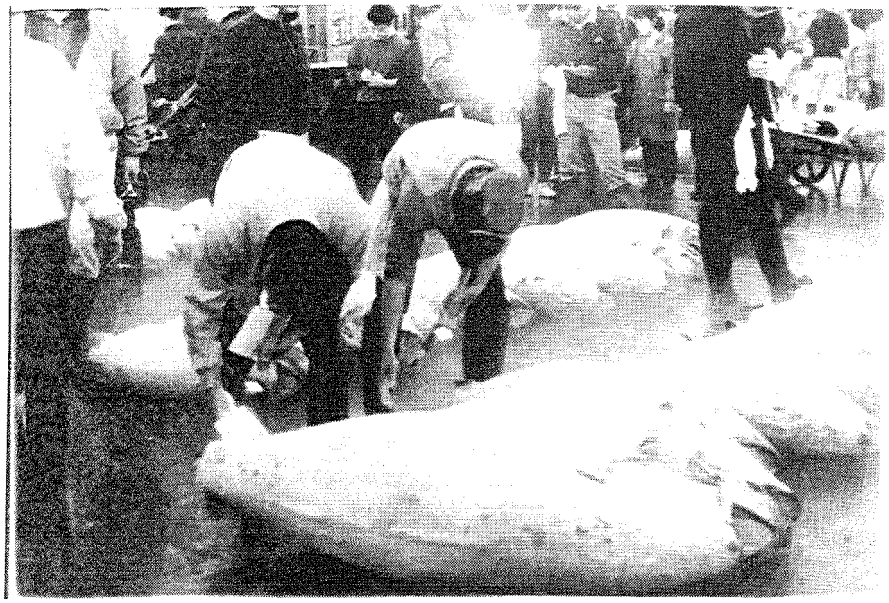

Figure 7. Frozen tuna at Tsukizi market in Japan.

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MEASURING THE QUALITY OF SEAFOOD PRODUCTS: USING MICROCOMPUTERS AND STATISTICAL PROCESS CONTROL IN THE SEAFOOD INDUSTRY

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INTRODUCTION

There are many ways and reasons to measure the quality of seafood products. Using computers to assist in this monitoring and then reporting the information in a usable manner makes even more sense. The purpose of this paper is to discuss some computer aids to help seafood processors become more profitable, that is, to have better control over the production environment and, at the same time, keep buyers and government agencies satisfied.

Unfortunately, as a rule, the seafood industry is behind in monitoring the quality of its products and its production processes. Canners are the exception. The good news is that processing seafood is really no different than thousands of other manufacturing operations. There are lessons to be learned, and some of these other methods can be adapted to seafood. The size and location of the seafood processor do not seem to matter. Whether the facility is big or small, in a large city, small coastal town, or on fishing boats, the technology is there and, albeit slow in arriving to the industry, has already proven its value.

Some of the things described here are used on Golden Age Fisheries vessels and by the office staff to report to buyers prior to delivery.

WAYS TO MEASURE QUALITY

First, what is quality and why does it need to be monitored? Quality has many meanings to many people. Quality is the set of attributes or characteristics of a product that the customer needs. To keep a customer, you must satisfy the customer's demands. Quality attributes for fish fillets might include color, texture, size, number of bones, and odor.

Traditionally, the measurement of quality is based on inspection of finished product rather than inspection of the product at each distinct processing step. Understanding the difference between these two methods is vital to improving quality attributes and being able to summarize these parameters for the customer.

FINISHED PRODUCT INSPECTION

Finished product inspection is based on a sample, and tests are carried out to try to detect if the product is good enough or if it is too bad. Sampling itself adds variability into this step. By chance a sample can be representative of the rest of the product or not representative at all. In any case, if a problem is found, such as there are too many bones in the fillets, the production effort was wasted. Instead of doing the processing steps right the first time to achieve optimum quality, the company made an out-of-tolerance product. The quality is already in the product and it is too late to change anything without cost.

If a problem exists, the focus then shifts to disposition. A good sales person can sell anything, but at what cost? The process from this point is filled with lost time, labor, and money. It would have been much better to have avoided these problems in the first place.

Finished product testing is not only inexact and too late in the process; it does not answer a number of other questions either. For example, during production of individually quick frozen (IQF) fillets, the number of bones per pound of product must be monitored. The customer will not accept more than one bone per pound. If during an inspection three bones per pound were detected, the only thing that is known is that the sample is out of specification. Looking at the result of the inspection does not tell where the problem occurred or if it is representative of the complete production.

Was it a candling line error by one person or by everyone? Did the automatic fillet machine miscut so badly that the best candling inspector could not have kept up with the flow? Were discarded fillets accidentally being packed in with the "good" fillets? If the problem was detected at all, the problem was in the box quickly and it is too late to fix it. Where do you sell this product? What about the money already invested?

In spite of the inherent shortcomings of this old system of inspection, many customers Still rely on finished product tests because fish is treated as a commodity. To understand how a product will be seen by the customer, it is wise to carry out a minimum level of finished block inspections in the same manner as the customer.

Any company trying to make a new product should first get the customer's incoming inspection form and follow it (for example, see figure 1.) The company should double check the procedures on a day-to-day and hour-to-hour basis. Some customer would like to see the results of the effort written down because it will reassure them that tests are being made and it saves them time in duplicating the same procedures (figure 2).

German whitefish buyers - like many companies here in the United States - rely upon finished product testing to determine the acceptability of numerous quality attributes. German companies use statistical tests such as a standard deviation of measurements. The results of these tests from the production plant are compared to those found once the product arrives in Germany. Information from both sources are also compared to what was done in the past from one supplier and several competitors. The historical statistical information provides evidence and a basis for comparison. Phrases like "Don't worry about quality; everything is OK, we promise it's good" are only empty words without the evidence. More important, more and more companies are refusing to buy from suppliers that don't have hard evidence of what was produced in the plant.

In summary, finished product inspection in seafood is based on how many samples are examined, to get the best picture, many samples must be taken at an ever increasing cost. Years of experience have proven that finished product testing doesn't work with seafood any better than it does with making ball bearings, car doors, or food for NASA But for many years, finished product inspection was all that was used. Its practice still exists and will be with us in some areas (possibly Germany) for some time to come.

STATISTICAL PROCESS CONTROL

There is a better way than finished product inspection The method is called statistical process control (SPC). The method provides statistics, information on the process in real time, or, evidence that satisfies the buyers. Importantly, this technique monitors the process to prevent a problem from being produced in the first place. It is not necessary to use a computer for this analysis, but a computer makes it much easier.

SPC emphasizes the measurement at key steps in a process to assure that the product will be good. An example is monitoring samples of fillets four times every hour from the candling line (frequency and number of fillets examined are based on a sampling table). If the count of bones goes over the specification number, the machines, the people, or other factors can be examined and the exact problem pinpointed.

A program of monitoring control charts is the fastest method of observing a process that is going out of control and determining when to make adjustments to the processing line. SQCpack, by PQ systems (available locally from Research Consultants, Seattle, Washington, 206-933-6663), is one of the most frequently used programs by seafood buyers and is very easy to learn and use.

RUN AND DISTRIBUTION CHART

A simple run chart may be all that is needed to see if your process is under control and to monitor the variance in the process. See figures 3 and 4.

By studying a control chart, another tool in the SPC armory, you can know the variability in a process over time. The major concerns (in this case defects of bones, fins, and parasites) are recorded, a summary is graphically plotted, and, if a problem occurred, the disposition of the product is noted. In the example, the product is being checked every 15 minutes and a total defect level of greater than two, is clearly visible. Action should be taken in such an incidence and the product reworked or downgraded.

Control charts can be made by hand or generated with software such as SQCpack if it is linked to an electronic balance or other measuring device, even calipers or light sensors.

The best place to use a control chart is in the factory, hands on. Because of the wet environment at sea, computers have not been very practical. The Marel scale/computer system that tracks product inventory and weight control is a notable exception. If computers are not practical, manual control charts, waterproof paper and a pencil will work and provide a wealth of information in a timely manner.

PROCESS CONTROL DEFECT LEVELS

MANUFACTURER: _____ TECHNICIAN(S): _____

PROCESSING FACILITY: _____ DATE: _____

TIME AM PM	# BONES	#FINS	# PARA-SITES	TOTAL DEFECTIVE	USL 0	1	2	3	4	5+	COMMENTS
00:15											
00:30											
00:45											
01:00											
01:15											
01:30											
01:45											
02:00											
02:15											
02:30											
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06:00											
06:15											
06:30											
06:45											
07:00											
07:15											
07:30											
07:45											
08:00											

COMMENTS _____

ADAPTED FROM: MRS. PAULS/CAMPBELL SOUP

Figure 1. Mrs. Paul's /Campbell Soup raw product inspection format.

FINISHED BLOCK INSPECTION

TYPE OF PRODUCT _____

PRODUCTION PLANT _____

TECHNICIAN _____

DATE INSPECTION DONE _____

DAY CODE & PERIOD	UNIFORMITY OF SIZE	UNIFORMITY OF WGT	PACKAGING COMMENTS	DEHYDRATION	FOREIGN MATERIAL	IMPROPER FILL	BONES	FINS	PARASITES	BRUISES	BLOOD SPOTS	SKIN	SCALES	BELLY LINING	NAPE	TEXTURE	FLAVOR & ODOR	FILLET COUNT	PERCENT DRIP	TOTAL DEDUCTIONS	TOTAL SCORE	COMMENTS

POINTS ARE DEDUCTED FOR VARIATIONS IN THE QUALITY OF EACH FACTOR. THE TOTAL POINTS DEDUCTED ARE SUBTRACTED FROM 100 TO OBTAIN THE SCORE. FOR FISH TO BE USED, THE TOTAL DEDUCTIONS MUST NOT EXCEED 15 POINTS.

MODIFIED FROM: MRS. PAULS/CAMPBELLS SOUP INC.

Figure 2. Mrs. Paul's / Campbell Soup finished product inspection format.

PACIFIC WHITING FILLET WEIGHTS

11-30-1993 02:22

File: OREG003
Company: GOLDEN AGE FISHERIES
Plant: NEWPORT PLANT
Characteristic: PACIFIC WHITING FILLET WEIGHTS
Sample frequency: ONE / HR
Units: 1 FILLET

Moving range, n=2
LCL = --- **MEAN=5.8 UCL=19**

Individuals
LCL=48.5 MEAN=64 UCL=79.4

USING TABULAR CONSTANTS, BASED ON SAMPLES 1-106

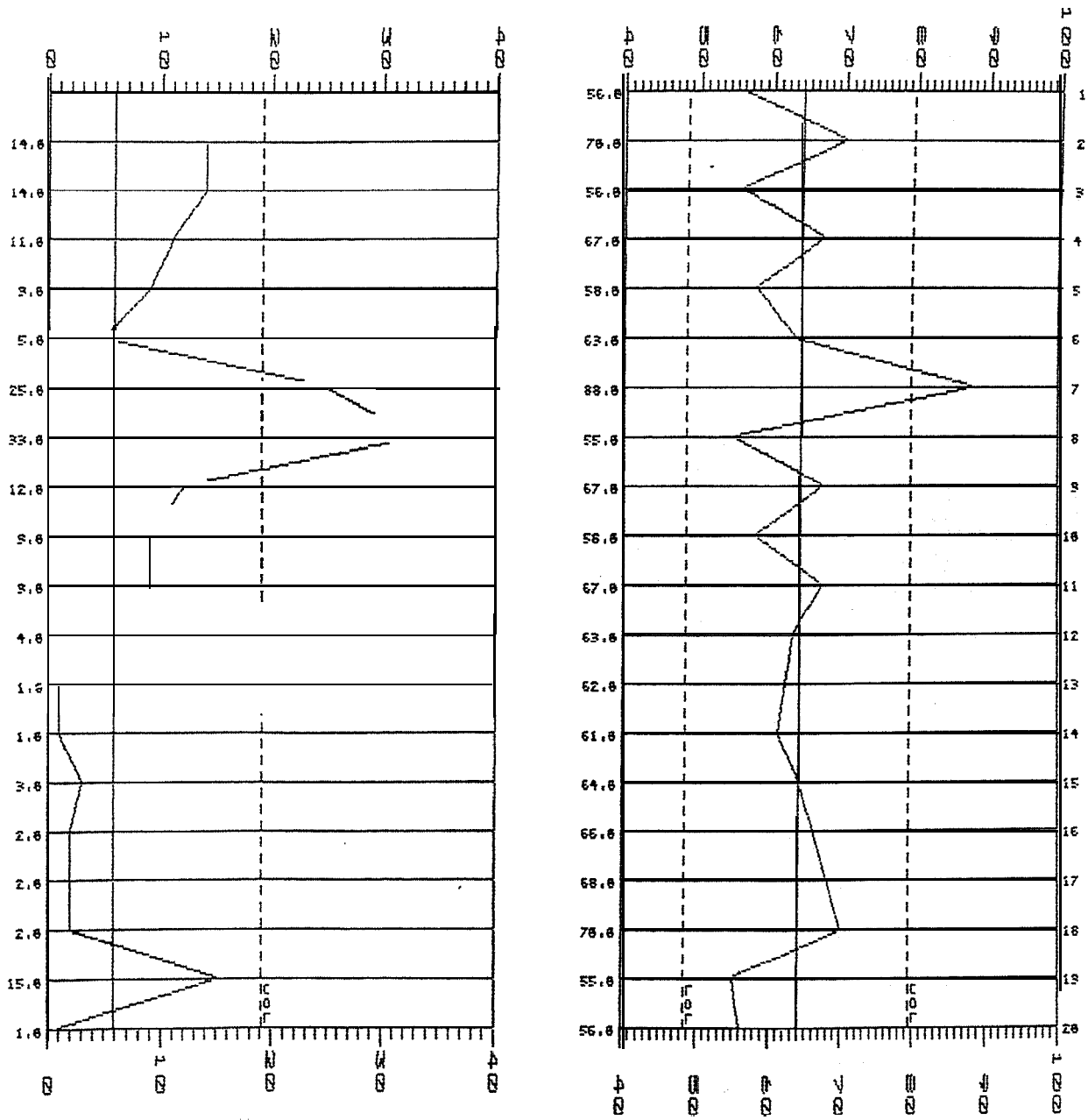

Figure 3. ***Run Chart from SQCpack showing upper and tower control limits. This format shows the variability associated with production data.***

File :OREG003
Company :GOLDEN AGE FISHERIES
Plant :NEWPORT PLANT
Department :
Machine :
Operation :
Characteristic :PACIFIC WHITING FILLET WEIGHTS

Date:ll-30-1993, 02:39:11
Part name :
Part number :
Sample frequency:ONE / HR
Units :1 FILLET

Descriptive Statistics

All (n=l)
137 data points
Mean = 64.3
Sigma Indiv= 7.8
Est. Sigma = 4.1
Coeff.Var. = 0.1
Mean + 3s = 87.9
Mean - 3s = 40.8

Min. Value = 47
Max. Value = 88
Kurtosis = -0.151
Skewness = 0.360

Interval = 3.0
lower boundary
Chi Squared= 9.710
deg. free. = 7
Conf. Level= 95%
Normal

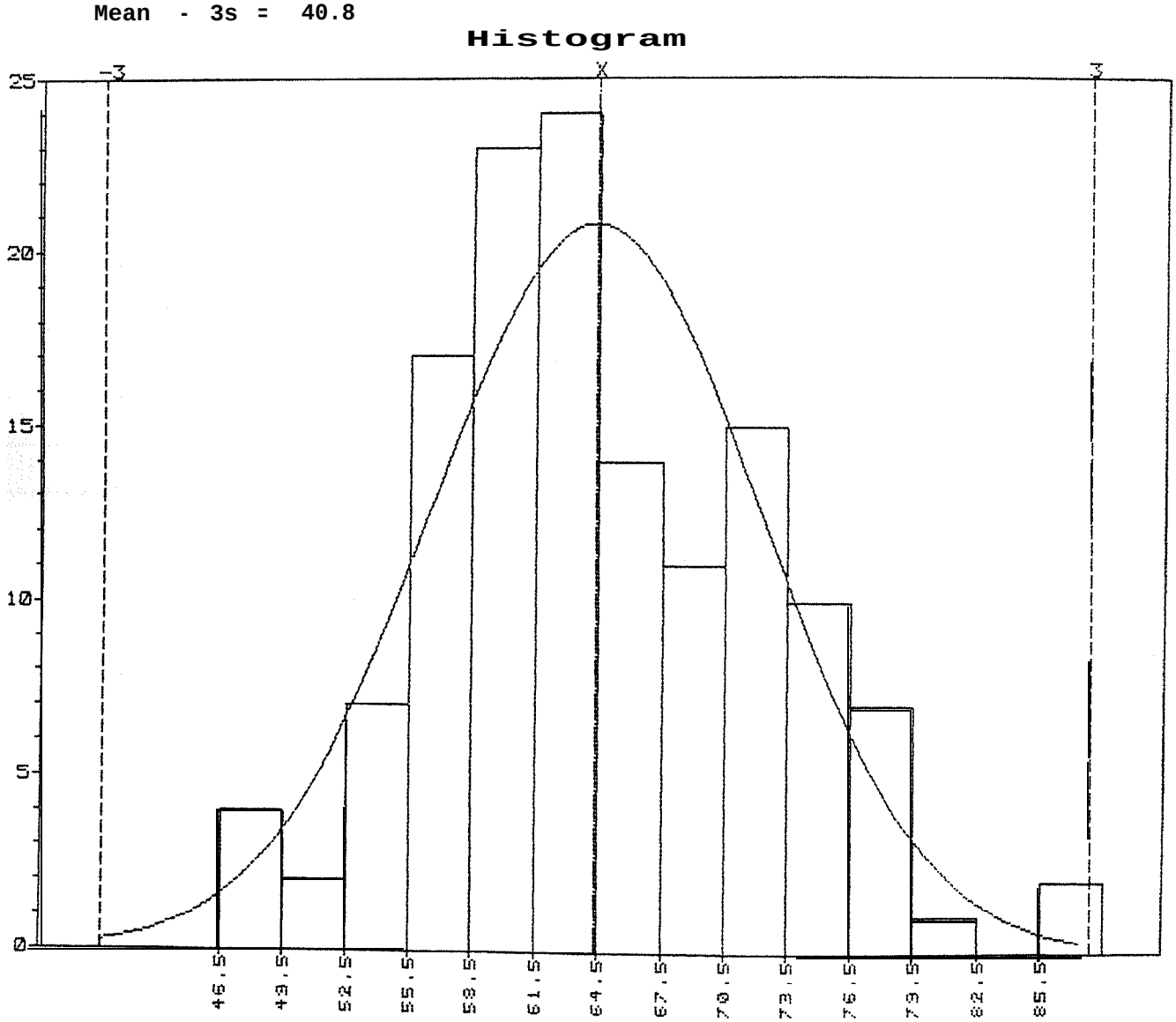

Figure 4. Distribution chart from SQCpack. Weights of Pacific Whiting fillets.

Control charts provide a basis for separating random from nonrandom events in a process. The goal is to have a production system that has inherent variation from random causes only. In addition, control charts help keep future production similar to what has been previously determined as acceptable. Consistency of Product is very important to any of the buyers, whether the product is H&G rockfish, surimi, or fillet block.

Photocopying all the paperwork produced for the buyers or government agencies is not worthwhile because of the difficulty for someone to interpret the mass of excessive detail. Summaries, on the other hand, are valuable to many buyers of product. Using a data base program such as R:Base allows selection of defect levels, weight checks, microbiological tests, freezing temperatures, chlorine logs, sanitation checks, and many other tests that are important to buyers. This detailed summary information helps sales of seafood products fit with the buyer's needs and gives the level of confidence necessary to keep customers.

A relational data base allows selection of a specific day's production, product type, or another category that may be of interest to a customer or production Staff. Selection of information does not overwhelm the client with inappropriate data, comments, or formats that the customer can not relate too. Customers appreciate a one-page summary and can always ask for more information if they need it.

Weight histories on a daily basis along with the rest of the processing information have saved thousands of dollars in product claims when small buyer samples come up with skewed sample weights that are not truly representative of the shipment. Daily weights also allow production staff to adjust their pack weights so that just enough product is leaving the facility, not too much or too little. The savings in this one area will, by itself, pay for the software and computer equipment many times over.

Summary information, with originals available as reference material, is also acceptable to the National Marine Fisheries Service in association with HACCP certification and will be acceptable to the Food and Drug Administration and other government agencies as programs are proposed at this time.

MAKING QUALITY PAY: STRATEGIES FOR IMPROVING SEAFOOD QUALITY ON FISHING VESSELS

Jim Ostergard
New England Fisheries Development Association

During the 1970s, the stocks on the Georges Bank fishing grounds, considered to be the richest fishing grounds in the world, were routinely attacked by 13 to 15 different nations, including the U.S. and Canada. The fleets of the U.S. and Canada were antiquated, mainly composed of smaller, wooden, "eastern rigged" side trawlers, while the foreign nations had large, well-supported fleets of steel-stern trawler-catchers and large factory trawlers and processors. Supply fleets of freighters and tankers allowed these fleets to stay on the grounds for periods of as long as 9 to 12 months. The Magnuson Act became law in 1976, extending our territorial waters to 200 miles, thus effectively eliminating the foreign competition for our stocks.

During the remaining years of the decade, the U.S. fleet slowly converted to steel-stern trawlers as replacement vessels for the older wooden-side trawlers. Landings for a six- to seven-day trip to the fresh markets of 80,000 to 100,000 pounds were common. Generally, the industry was satisfied with the commodity mentality of the fishery. However, a small group became concerned that we were losing market share and that the resource would not hold up.

An industry group made up of harvesters, processors, and end users in the major markets of New Bedford and Boston came together with the New England Fisheries Development Association to plan a strategy for the future of the region's fisheries. The major areas of concern were impending stock reductions and loss of market share caused by higher-quality imports from other countires in the North Atlantic basin.

Funding was secured through the Saltonstall-Kennedy Fund from the federal government, and the Quality at Sea Project was launched in 1981. It was felt from the outset that because this project came from industry, it must include active participation and support from across the industry. We needed to tackle the question of the quality of landed product and the impact of the entire processing and distribution chain on the ultimate quality of the product delivered to the end user, the consumer.

Oversight for the project through the trade association, its broad-based membership, and an industry oversight committee was an important component of the project's management. Equally important was the project director, Captain Eugene Connors, a 25-year veteran of the New England groundfishery who came ashore to manage the day-to-day efforts of the project. A key to the team building and problem solving needed in such a project is the ability of the personnel involved to transcend social and personal differences between harvesting and shore-side production, distribution, and marketing of the product.

After an exhaustive literature search of methods and tools available, the participants set up guidelines for vessel participation. The project director enlisted the volunteer help of a high-line trawler and went to sea with equipment and methodology to implement the first phases of the product. Of major importance was this groundwork, which took a hard, long, and collaborative look at how we were doing the job of harvesting and of transporting catch to the market.

In addition, the harvesters themselves, from numerous vessels and feeder ports to the major ports in the region, were enlisted in the process. It was felt from the outset that this was an opportunity for industry to demonstrate its expertise. The empowering effect of this ground level participation generated further enthusiasm for the goals of the project. Often tips on handling that the "old timers" remembered or had passed on to their sons or mentors turned out to be helpful in planning the next steps of the project. The four major goals of the project were to (1) develop quality fish handling procedures, (2) demonstrate the benefits of those procedures, (3) establish a price differential for premium fish, and (4) reduce the labor intensiveness of producing such fish.

On board the vessels, attention centered on sanitation, work flow, and storage methods.

Traditional bulk storage of product in pens 10 to 12 feet deep was compared with shelving and short shelving the fish pens to reduce the weight on the fish. Boxing of fish on board rather than bulk stowage was demonstrated using side-draining, nesting plastic fish boxes from Norway and Iceland. The boxing demonstration was introduced on the volunteer trawler, the F/V *Odin*, sailing out of New Bedford, Massachusetts.

Early in the project, bled and boxed codfish was placed on the fish auction in New Bedford, which is a "blind" auction, not a display auction. Despite the high quality of the fish, it received a price below the market, which was a clear message from some of the dealers and processors opposed to change. Subsequent sales of fish landed during the remainder of the project were made "under the door" to processors involved in the project. (A display auction was established in Portland, Maine, after the conclusion of the project, and a premium was established there for boxed and bled fish.)

Using a combination of private, academic, and government agencies, we followed the fish produced under this project through the distribution system. We measured shelf life and quality attributes to document the advantages of special handling on board. A manual for use on board the vessels was written and distributed as was a processing manual during the years the Quality Project worked along the Massachusetts shoreline. National trade media, as well as local and regional newspapers, reported the findings of the project.

Project personnel didn't confine themselves to the trip boats from the larger market ports (Boston and New Bedford). Numerous trips aboard other trip and day boats from the ports of Gloucester and Provincetown established a network of information about the advantages of the fish-handling systems approach demonstrated during the project.

Having set the stage along the Massachusetts shore, organizers extended the project farther east to include the Maine and New Hampshire coasts in 1984. Fish along those coasts were marketed in a different manner. Most ports, with the exception of Portland and Rockland, Maine, were located many miles from major markets in isolated rural ports. Fresh fish were typically landed at a small processing facility with whom the vessel captain had a marketing and supply relationship. Part of the catch might have been processed and part shipped to Boston, New York, and Philadelphia or other distant markets on consignment. Often the vessel didn't learn the price of those fish until returning from the next trip, and recourse to pricing was limited.

The Maine Groundfish Association, in conjunction with the Maine State Department of Marine Resources, worked with the New England Fisheries Development Association to bring the project to their members. Again, this was a diverse group including vessel operators, processors, brokers, and regulators. This oversight group felt it was of the utmost importance that the project leader come from the harvesting sector so that little time would be wasted in presenting the program and it would be much easier to sell the program goals.

Using information and experience gained from the first stages of the project, the team selected several volunteer vessels from three ports to participate. These vessels reflected different market conditions and different styles of vessel management. One trawler was part of a large vertically integrated processing and marketing facility; the second reflected short-trip, independently owned vessels; and a third was a large trip boat that sold on the open market. Several processors actively worked with the project team, allowing sensory inspection of product after receipt either by vessel or truck and allowing the state inspectors to participate. At this time, additional laboratory testing was done to corroborate sensory grading of the fish shoreside.

During the later phase of the project, the goal of improving the quality of the landed product was further investigated by looking at three factors affecting the quality of the fish: enzymatic and bacterial breakdown after the fish has died and the effects of rigor mortis on the overall quality and shelf life of the product. Given a good sanitation regime in place on board, it was concluded that temperature control and proper handling were the most important factors affecting the quality of the product. Fish hauled up the stern ramp warm to the sea surface temperature. During the winter months in the Gulf of Maine, it is not uncommon to have surface water temperatures in the 40 degree range.

Traditional deck practices often leave fish on deck for extended periods of time, and because of the style in which they are moved from checker to checker, the fish are prone to bruising and increased deterioration from bacteria and enzymes located on the fish themselves. When fish can be rapidly chilled, their time in rigor mortis is extended; this extends

the shelf life of the product. Storage techniques also affect the overall quality of the fish. Bulk storage is the most damaging, followed by shelving. The best technique for preserving the inherent quality of the harvested product is boxing the fish at sea. The economic return to the harvester from improved storage methods can exceed 12 percent more landed weight from boxes than from bulk storage. Other containerized methods have merit as they too can reduce weight loss prior to landing the catch.

Solutions to the work flow on deck most often came from the crews themselves, and because of the capital requirements of large-scale cooling systems, proved to be a simple and low-cost alternative. A case in point: The use of wharf boxes with circulating seawater to keep fish wet and at a constant temperature greatly influenced the quality of the landed catch. In addition to preventing bacteria buildup, it kept the fish from bruising and allowed bleeding. Viscera, when removed, did not recontaminate the fish.

Shelf life studies indicated that properly handled boxed codfish could maintain its shelf life for up to 21 days from harvest.

By the end of the project in 1985, all the goals of the project had been met. Its findings were widely published in the trade press and were available in manuals. Personnel involved in the project spoke on many occasions to all sectors of the industry, from harvesters to processors, retailers, and food service operators. To this day, individuals are profiting from use of the systems advocated during the project. However, the industry as a whole failed to adopt many of the recommendations of the Quality at Sea Project.

With the HACCP-based system of seafood inspection about to become mandatory, it would be timely for the industry to revisit these fish-handling recommendations.

Quality Assurance: Concepts in Management

DEVELOPMENT OF QUALITY IN THE NORWEGIAN FISH-FARMING INDUSTRY—FROM QUALITY INSPECTION TO QUALITY MANAGEMENT

Terje E. Martinussen
Norwegian Institute of Fisheries and Aquaculture

THE DEVELOPMENT OF THE FISH-FARMING INDUSTRY IN NORWAY SINCE 1980

The farming of salmon in Norway consists of many small units, with a relatively uniform technology based on floating dip net systems. Seven hundred twenty-nine units were registered in 1991. While 190 units are approved for smolt production, several of them are being integrated with the farming of fish.

Growth in Volume

The fish-farming industry in Norway, based on the farming of Atlantic salmon, developed during the 1980s from a relatively modest industry to a large, economically significant industry. Volume rose from approximately 7,500 metric tonnes in 1980 to over 160,000 metric tonnes in 1990, but has fallen to approximately 130,000 in recent years. Fish farming from 1983 to 1993 has been marked by steady growth up to 1987 and an explosive increase over the period from 1987 to 1990, which has been the peak year to date.

Such sharp growth has been possible because Norway has good natural conditions for fish farming and has had the necessary technology and expertise. Furthermore, active efforts have been made to market fish products.

This development in the fish-farming industry has occurred despite relatively strict regulations governing participation and the size of units. Fish farming has been a licensed industry, and so not everyone who has wanted to has been able to set up in business as a fish farmer, There have also been stipulations on the expertise required (minimum final exam in aquaculture from upper secondary school or relevant professional experience), on who is entitled to own farms, and on the size of the farms, with an original maximum of 8,000 cubic meters that in 1988 was increased to 12,000 cubic meters.

Price Development

The price of Norwegian salmon increased in the first phase of the fish-farming adventure. It rose regularly and steadily up to 1985, when an average price was recorded of NOK 54.22 per kilogram of fresh salmon. Since 1985 it has been clear that Norwegian salmon is encountering greater resistance in the market, with increasing competition from other countries and other products in the food market. The sharp increase that has occurred in Norwegian production also means that since 1985 there has been more intense competition between Norwegian producers and exporters, showing clearly that salmon no longer sells itself We are thus witnessing the transition from a seller's market to a prolonged period in which there is a buyer's market, and major challenges have to be faced in marketing and market development.

To counteract the effects on price of the sharp increase in volume, a scheme was established in 1990 under which a marketing cooperative, the Norwegian Fish Farmers' Sales Organization (NFFSO), started to buy all surplus fish. This fish was frozen and stored at low temperature (-50°C) to be sold in the market during periods of reduced supply and so ensure more stable prices. In view of the size the "salmon mountain" gradually assumed, while individual fish farmers were not at the same time reducing their production, the existence of this stock of salmon in itself became a source of concern, creating uncertainty and low prices in the market. Finally the cost of this freezing scheme became so high that NFFSO and several salmon farmers went bankrupt in 1992. The stock of frozen fish from this period has now been sold.

Organization of Sales

Right up to the time of the bankruptcy in 1992, the sale, processing and exporting of

farmed fish was regulated[1] under the Raw Fish Act. This statutory protection was entrusted to NFFSO, whose task was to organize and check sales of farmed salmon and trout to approved exporters. This responsibility puts the sales organizations in the fisheries industry in a special position, on the one hand performing administrative tasks on behalf of the authorities and on the other attending to the interests of a group of fish producers.

After the bankruptcy, both direct and indirect sales were deregulated. Many people claim the bankruptcy came at an opportune moment, with the result that the adjustment to the European Economic Community (EEC) could be made less painfully. The system involving a dominant marketing cooperative in the fish-farming industry was claimed by many to be contrary to the market regime in the EEC; critics felt that it might therefore be declared invalid by the EEC, which has a system of voluntary producer organizations (PO). In practice, the discontinuation of NFFSO has implied that the old system of approving purchasers of salmon has been done away with, while a change in the export law has provided greater freedom for performing export services. Today, an export license is given on the basis of economic soundness rather than on performance in the market. The result is that there are now more exporters. This has meant the start of a certain amount of restructuring in the fish-farming industry. I shall return to this later in the article.

MARKETING OF THE NORWEGIAN SALMON TRADEMARK UNDER THE DIRECTION OF NFFSO

NFFSO showed itself early on to be a sales organization that differed from the other marketing cooperatives in the Norwegian fish-farming industry and played an active role in promoting the joint marketing of Norwegian salmon. In the traditional whitefish sector, the marketing cooperatives have had very little involvement in activities other than direct sale, that is, fixing prices, directing catches, and undertaking various inspection duties on behalf of the fisheries authorities.

Through the Market Council, a council made up of representatives of exporters and producers under NFFSO's management, NFSSO has worked towards the joint promotion and marketing of Norwegian farmed fish (generic marketing). The aim was to give Norwegian salmon and trout a profile as "the finest and freshest fish on the market" and establish this product as a trademarked product of high quality.

As part of this strategy, separate operational units were established in the main markets of France, Germany, Spain, and the U.S. The market offices conducted practical market work in the form of trade fairs, advertising campaigns, and direct contact with customers of Norwegian salmon exporters. The work focused on establishing the trademark and concept of Norwegian salmon in the market. A survey undertaken among importers and distributors of Norwegian salmon in the U.S. before trade restrictions were imposed on imports, shows that Norwegian salmon was regarded as the best quality and the best value for money (Olsen 1992).

The marketing effort on behalf of Norwegian salmon grew steadily from the time the Market Council was set up in 1979. The budget in 1979 was NOK 640,000, rising to NOK 62 million in 1990. It is clear, therefore, that the bankruptcy of NFFSO has resulted in a severe setback for the joint marketing of Norwegian salmon abroad. Marketing was financed by a compulsory levy on all sales of products through the cooperative.

Budget (NOK):

1986	1987	1988	1989	1990
12.5 m	25m	35 m	55 m	62 m

The dominant position Norway held in the total market for salmon meant that the marketing activity to some extent also benefited fish farmers in other countries. The problem with this type of marketing is that it is difficult to make the effect of the promotional work exclusive, so that when the customers have been persuaded to demand more salmon, it is not certain that they will demand salmon from Norway; they may just as well buy salmon from other producer countries, depending on availability and market price.

The marketing of Norwegian salmon has demonstrated how difficult it is to establish an exclusive trademark or concept unless the one who undertakes the marketing work also has responsibility for production and quality inspection as the individual actor in the system. It is easy to be wise after the event-certain

[1] Royal Decree of 28 July 1978, pursuant to the Raw Fish Act of 14 December 1951

things that could have been done differently can readily be identified. For example, we should have registered the Norwegian Salmon trademark. Today we can see the results of not having done so: Norwegian salmon can be found on the menu in virtually every restaurant in the U.S., despite sales having almost completely ceased in 1991. By way of comparison, it may be mentioned that New Zealand has protected the Greenshell Mussels trademark with great success. We have witnessed the same development in Scotland, where the trademark has been protected through the introduction of a certification and inspection scheme for approved producers of "quality approved Scottish salmon." Producers must be approved (certified) before they can use the trademark.

From the Norwegian point of view, the lack of supervision of individual producers and exporters meant that quality became uneven. Although the vast majority could still produce products of the right quality, it does not take many rotten apples in a barrel to spoil the overall impression.

The lack of supervision over the production and sale of farmed fish resulted in the products ultimately presented to the customer not always living up to the expectations aroused by our mass marketing efforts. To some extent this weakened trust in Norwegian salmon in the market. It has been particularly apparent that the quality of Norwegian salmon has dropped in periods of overproduction and tough price competition. When the authorities had in addition cleared the way for free exports, several unscrupulous actors entered the arena. Their entrance soon weakened the quality image of Norwegian salmon, which had been built through a long and laborious process.

The lack of supervision was not a problem just in primary production; it was just as much of a problem in the distribution chain through to the customer, where salmon of differing quality was sometimes mixed together and sold as "superior Norwegian salmon."Nor was it difficult to get hold of Norwegian gill clips and attach them to fish of different quality and from different countries of origin. The "problem" of gill clips that are too solid has led, for example, to work in Scotland to develop a mark that falls off more easily and thus makes unauthorized reuse of quality marks more difficult. Workers are also examining ideas for the permanent labeling of individual fish, the use of bar codes, and so on.

QUALITY INSPECTION AND THE DEVELOPMENT OF THE STANDARD PRODUCT NORWEGIAN SALMON

The fish-farming industry decided on a strategy of supplying a raw material of the highest possible quality and thus making the product attractive in the market. In addition, the strategy involved supplying the product in large quantities.

The philosophy was to supply the finest and best fish, based on the ideas that "high quality will certainly find a market" and "high quality can be put to any use required."

Superior Salmon

To safeguard quality, a relatively simple system for grading salmon in different quality classes was established in 1985: superior, ordinary, and production fish.

The grading system was made subject to public quality inspection and thus represented a minimum standard of quality it was legally permissible to put on the market. For many fish farmers, this unfortunately also became a maximum standard, and the aim became to produce as much as possible as cheaply as possible. There was thus no need to make an effort to produce a product that did more than satisfy the requirements laid down by the supervisory authorities. The proportion of superior salmon at first was around 90 percent but fell as the volume of production rose.

The grading system established was a rather simple and subjective one, with grading according to size and glossy surface, and to a lesser extent a grading according to raw material-based characteristics (fat, color, consistency). The emphasis was put on the external quality characteristics of the raw material (appearance) and less account was taken of the quality requirements necessitated by different products. The system therefore became vulnerable to variations in quality, while at the same time everyone was marketing the product under the common quality mark of Norwegian salmon.

To avoid the adverse effects of the trust placed by the market in Norwegian salmon, individual exporters chose to establish their own trademarks, such as Grand Nord, to ensure the necessary recognition and trust.

Development of Norwegian Salmon

As part of producing a standard product of high quality, NFFSO, in cooperation with the

trade organization, the authorities, and research councils, launched research and development programs such as New Fish (research into new species) and Healthy Fish (research to prevent and combat disease).

In addition, NFFSO launched its own activities with emphases on health monitoring, veterinary service, breeding, and computer systems for information and production control.

The purpose behind these activities was twofold: to develop fish with better quality characteristics and to make a greater commitment to training fish farmers in correct technology and processes for producing Norwegian salmon. In addition to this developmental work under the direction of NFFSO, Norwegian feed manufacturers and research communities made their own contributions to research and development, which has benefited the fish-farming industry.

Personnel were offered short courses in subjects such as breeding, feed and feeding, production and financial management, slaughtering, and quality grading. NFFSO also employed its own production advisers for the direct training of fish farmers. The training was organized through a separate foundation - the Aquaculture Training Foundation - which the sales organization established in 1988 in cooperation with the Norwegian Association for Aquaculture Research and the Association of Norwegian Fish Farmers. The objective of the foundation is to hold courses for fish farmers and foster closer cooperation between researchers and fish farmers.

The Fish Inspection Authority (Fiskeridirektoratets Kontrollverk) has also been used by the NFFSO in setting up the system and supervising the actual grading.

Towards the end of the 1980s NFFSO began working to a greater extent on questions relating to the standardization of production processes in the industry, for example, standards for the measurement of fat and color so that this could be quantified,

In connection with the freezing scheme, standards were drawn up for the handling and freezing of fish to ensure optimum quality and shelf life for the fish.

Developments in the market, with preparations for the establishment of a common European market with common rules for standardization and certification, also helped persuade NFFSO to give more thought to the certification of farms and businesses towards the end of the 1980s.

FROM QUALITY INSPECTION TO QUALITY ASSURANCE SYSTEM

In 1988 the Good Fish Project was launched as a collaborative project between the authorities and the fish-farming industry. The aim was to bring together knowledge about quality work in one organization, spread this knowledge, and point out the need for research and development. The work was project oriented in the initial phase, with the emphasis on projects to improve the quality of Norwegian salmon and bring about a more uniform conception of quality among practitioners. In time, the Good Fish Project developed to become a driving force behind the establishment of quality assurance systems and certification in the fish-farming industry.

As part of the work to improve the quality of the Norwegian salmon product and to develop more customer-related product specifications for fresh farmed salmon, a wide-ranging customer-market survey was conducted in the period 1990 to 1992 under the Good Fish Project in the nine most important markets for Norwegian salmon (Koteng 1992). One of the conclusions from this survey, which was mainly conducted among importers, wholesalers, and smokeries, was that the five most important quality criteria are

1. freshness
2. color of the flesh
3. consistency
4. red gills
5. fat content

The results of the survey emphasize that customers in different countries and in different groups have differing tastes. This is reflected for example in different requirements for color and fat content, and thus differing assessments of whether Norwegian salmon is of good or poor quality.

An aspect that was emphasized as particularly positive in relation to Norwegian salmon is regularity of supplies. A negative aspect that was mentioned was that Norwegian salmon ought to be of more even quality.

The survey also confirms that European customers prefer Atlantic salmon to Pacific salmon.

This market survey supported NFFSO in its belief in the need to safeguard the quality of Norwegian salmon and to establish systems for quality assurance in the industry. Whereas in 1987 fish farmers were not at all receptive to the idea of introducing quality assurance

systems, by around 1990 the situation had changed substantially.

Plans were drawn up under the Good Fish Project and NFFSO to establish quality assurance systems in all Norwegian fish farms. To provide a basis for this plan, a systematic recording and description was made of all operating procedures in rearing, slaughtering, packing, and sales, in order to create standardized "model procedures" in the industry. The idea of a standardized product was also applied in the plan to introduce quality systems in fish farming.

The aim was to be able to certify all fish-farming businesses under NS ISO 9002. The possibility of developing a special quality emblem for certified firms that could be used in marketing was also discussed. This, as I pointed out earlier, was one of the shortcomings in the marketing of Norwegian salmon.

The aim was to implement a nationwide program, but because of the bankruptcy of NFFSO and inadequate financing, the project was launched as a trial project limited to the county of Hordaland. The results of the trial project will be the deciding factor in settling whether this program obtains the necessary funds to be expanded to other counties.

Because the quality program did not start until 1992, no conclusions can yet be drawn on how the work of establishing the quality systems has progressed. Our general impression is that the plan has focused too much on standard procedures in order to be more effective in producing a standard Norwegian salmon, and not enough on how to improve quality and how to bring about greater customer satisfaction.

EXPERIENCE FROM THE ESTABLISHMENT OF QUALITY MANAGEMENT IN THE FISHERIES INDUSTRY IN GENERAL,

Quality Systems in the Fisheries Industry

The Norwegian Institute of Fisheries and Aquaculture has been involved in three different programs for the establishment of quality systems in traditional fish processing, prawn firms and fish farms.

The Norwegian Institute of Fisheries and Aquaculture has had a dual aim in these projects. First, we have had responsibility for establishing quality systems in individual businesses and for training consultants, who in the next phase are to take on responsibility for establishing quality systems in new businesses. The motto has been to educate the educators, whether they be consultants or internal quality coordinators in the businesses. The Norwegian Institute of Fisheries and Aquaculture has also developed methods of finding an appropriate way of establishing quality systems in this type of firm and adapting the requirements of NS ISO 9002 to operational procedures in the fisheries industry. In addition, we have cooperated with a certification society to provide assistance with specialist knowledge of fisheries and take part in the certification work in businesses.

Method

The method that has been used is based on principles learned from experience. There is agreement that the employees are the most important element in a company's quality system. We have therefore invested a great deal of effort in developing a method that can commit and motivate the employees. The projects have been developed by a team consisting of researchers, consultants, and educators (Robertsen et al. 1992).

The projects are divided into two phases. The first phase focuses on the motivation and participation of the employees, in whom it is important to activate the knowledge already present in the firm. The employees are probably the firm's best "consultants," and active commitment is therefore valuable in many ways.

Improvement projects also occupy an important position in the first phase. Because priority is given to identifying and solving problems, the employees will see positive things actually being done in the firm so that they are encouraged to make further efforts.

Phase two focuses on documenting the quality system of the firm. This documentation also provides a critical examination of existing routines and processes. They are changed if necessary before the system is finally documented in a quality manual. The firms usually need to be supported in the work of structuring the material in the quality manual.

The first production firm was certified for quality work under the NS ISO 9002 standard in April 1993. More firms will probably be certified soon. The first firm in the fisheries industry, the export business NORFRA, was certified in March 1993.

What Has Been Difficult?

Experience from the projects has been favorable, and they will therefore continue with the

next round, albeit with a few changes. First, it is essential that the senior management should sign contracts stating that they will participate fully in the development project. If not, the firm will be dropped from the project.

A second point is that in periods of high production it has been difficult to set aside the necessary time for quality work in firms. Third, more emphasis should be put on improvement work in businesses. To remedy this situation, it has been decided that most firms in the next phase, depending on size, will have to employ a full-time person for two years to manage and coordinate quality work in the firm. It is important that every firm have specific tasks to work on at an early stage and that requirements be set for improvement. In this way the process is set in motion and the firms feel that they attain practical results in a reasonably short time. Most firms that have achieved or are in the process of achieving a 9002 certificate have worked on quality improvement and quality systems for at least three years.

The process of establishing quality management systems according to an international standard will be useful in the overall work of establishing TQM. Quality management and possible certification of it will therefore be one of the aims in a firm's development plans. The ultimate aim should be to have a production process and products that result in satisfied customers and satisfied staff, at the same time as the firm earns money.

EXPECTED DEVELOPMENTS IN SALES OF SALMON - THE NEED FOR QUALITY MANAGEMENT IN RELATION TO THE CUSTOMERS

The salmon market developed in the 1980s from being a relatively homogenous market with demand for a standard product distributed through long and complex sales channels.

As the market reached approximately 100,000 tonnes in 1987/1988, it divided into two separate segments. In addition to the traditional channel, a segment became established with several product variants, increased processing, and the establishment of shorter and more specialized distribution channels.

The third stage is developing a more segmented market, a large number of products, trademarked products, and sales through a few specialized channels.

Requirements and Trends among Salmon Buyers

Developments in the retail market have resulted in supermarkets' cooperating more closely with fish farmers and processors to define the best specifications and testing mechanisms to ensure that the requirements are met. The specifications are given in the form of manuals that are provided only to producers who enter the negotiation phase.

For supermarkets that sell their own brands, there should be the best possible checks on the source of the raw product. On the one hand, retailers in several countries are subject to strict legal requirements regarding product liability. On the other hand, the increased share of own brands makes it very important to check the quality of the products. This checking of the chain of supply has become visible through a close check of the selection of suppliers. It can therefore be expected that greater requirements will be set for formal quality approval according to an international standard in order to get into a negotiating position at all. Certification in other words is becoming a necessary, but far from adequate, condition for ensuring sales of products.

Product Specifications

Retailers set specifications for all the links in the chain of supply. They start with primary and secondary processing and go all the way back to packing and distribution. The specifications apply to the following areas:

Rearing:	operation of the farm, clean environment, feed, amount of biomass in the dip net, preparation for slaughtering
Raw material:	size, color, fat content, appearance, firm consistency, freshness, antibiotics, microbiological content, even quality
Processing:	hygiene, technical standard, handling, health and safety, chilling
Finished product:	taste, even size and clean cutting, slice thickness, packing, salt

	content, skinning, boneless, no blood patches
Delivery:	Fresh salmon must not be more than three days old when it reaches the retailer.

The retailers cooperate with a small number of suppliers, and the trend proves that it is worth maintaining a stable relationship with suppliers rather than change constantly and always be on the lookout for the best offer.

Salmon is changing in character, from a general commercial product of standard quality to a more differentiated product with many forms, qualities, and specifications. The price must be "right" and preferably stable over a given period. The main thing is to secure good and stable suppliers who can fit in with a given market concept or trademarked product.

Key actors in the industry believe that the future makeup of the industry will be as follows:

exporter-controlled fish farming	10-20 percent
integrated firms (export-production-rearing)	20-30 percent
joint operation (fish farmers with joint production plants, purchasing, slaughtering, and so on)	40-50 percent
individual firms (independent)	10-20 percent

Since the export monopoly was discontinued, we have seen a development in the direction of larger amalgamations of fish farmers and exporters. These amalgamations establish their own quality systems and use quality management actively in the groups' marketing. Development seems to be moving in the direction of statutory regulations that set certain minimum requirements a firm must meet with regard to health, environment, and safety while the detailed requirements on quality are developed in a close dialogue between the seller and purchaser.

Large customers in the European market will require a firm to have documented quality systems in order to enter into negotiations. If the group is accepted, the challenge will be to produce products according to detailed product specifications for customers. It is thus not sufficient to be qualified for the Olympic Games; you have to be properly prepared to win gold medals too.

We anticipate a stronger trend towards an increased number of products and consequently a need for producers who are flexible in adapting to different market requirements. Market orientation and marketing will therefore be key concepts in the 1990s.

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DEMAND FOR SEAFOOD QUALITY STANDARDS AND GRADES: THE CASE OF PACIFIC WHITING FILLETS

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INTRODUCTION

Quality assurance (QA) programs can generate several benefits to the seafood industry. These programs can result in higher product prices, increased sales, lower inventory costs, and reduced risk liability. They can help firms meet the requirements of national and international inspection programs in seafood quality and safety. QA programs also function as a framework for integrating marketing and production, as well as balancing costs and benefits. Such "marketing management" schemes can be helpful in developing production strategies that maximize industry objectives and opportunities.

Development of an industrywide quality assurance program has been proposed to improve market opportunities and reduce variation in Pacific whiting products. Past research has indicated that product consistency is important to industry buyers and may increase market prices, improve product reputation, establish brand loyalty, and provide market stability (Sylvia and Peters 1991).

The following paper summarizes some preliminary results from selected portions of an ongoing study sponsored by the Oregon Trawl Commission and the Oregon Department of Agriculture. The purpose of the study is to help Oregon seafood industries and fisheries management agencies develop optimal production, management, and quality control programs for Pacific whiting. Recently, over 100 surveys have been sent to groundfish industry members, including processors, brokers, wholesalers, and distributors. Survey questions were designed to delineate product quality issues and standards that affect fishers and processors in the Pacific whiting industry. The survey also attempted to explore the potential economic effects of adopting grading standards.

SURVEY/DATA DESCRIPTION

Three Pacific whiting product forms were included in this survey: individual quick-frozen fillets, headed and gutted, and surimi. Only the information obtained from the fillet surveys are discussed in this paper. The survey contained seven sections, which are briefly described below.

In the first section, respondents analyzed samples of frozen and thawed fillets that accompanied the survey. For individual frozen fillets, respondents scored the desirability of the package form, the general appearance of the fillets in the package, dehydration, and net weight. For the thawed fillet, respondents evaluated flesh color, appearance defects, fullness of flesh, texture, color, and overall consistency of product characteristics. The next section addressed the firm's experience with Pacific whiting. The third section focused on quantifying the importance of different product characteristics when purchasing whiting fillets.

In the fourth section, respondents were asked to select levels of characteristics that would define a grade A and grade B Pacific whiting fillet product. Respondents also scored the importance of various federal, state, industry, and firm inspection and grading programs designed to maintain and improve consistent product quality. In the fifth section, a hypothetical market experiment was conducted in which respondents identified the relative importance of frozen fillet characteristics in contributing to firm profitability. The "market" consisted of eight Pacific whiting frozen fillet products that represented a different combination of quality for five characteristics. The last two sections of the survey asked questions about the market potential of different Pacific whiting products and general firm attributes.

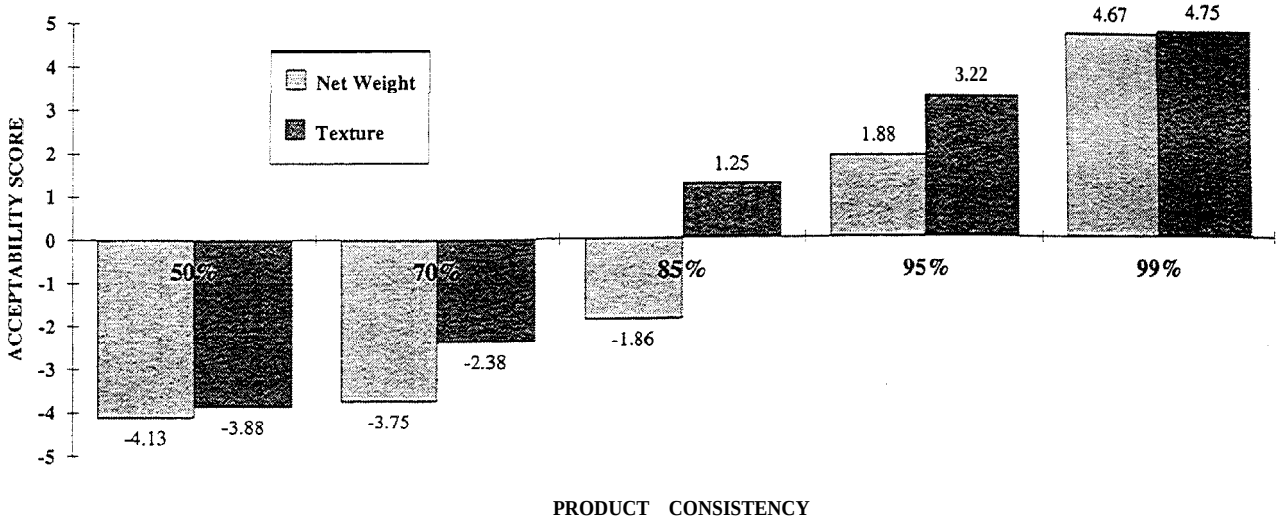

Figure 1. Acceptability score of product with varying consistency in net weight and texture.

SOME PRELIMINARY RESULTS

One important issue in developing a QA program is controlling variation in product characteristics. A seafood industry buyer may prefer to purchase a product that consistently has the same characteristics, even if the product has slightly lower average quality. However, maintaining consistency may be more important for some characteristics than others.

In the product quality section of the survey, respondents were asked to rank the relative importance of maintaining consistency for seven characteristics. Preliminary results show that net weight was the most important characteristic in maintaining consistency whereas texture was the least important (figure 1). The majority of respondents felt it would be unacceptable if 10 percent or more of the product packages were less than the stated net weight. Conversely, product remained acceptable if up to 20 percent did not conform to the stated texture. The five other characteristics surveyed had acceptability levels ranging from 10 percent to 20 percent, the order being bone count (similar to acceptability level of net weight), appearance defects, workmanship, shelf life, and color.

The remaining portion of the survey focused on the relative importance of different product characteristics for industry buyers and how these characteristics could affect profitability. Analysis was accomplished in three stages: (1) respondents developed two hypothetical grades by choosing a quality level for seven fillet characteristics; (2) results of a hypothetical market experiment were used to calculate break-even prices (see Sylvia and Peters 1991, for details of the analytical approach); and (3) a single optimization problem for a fillet producer was examined.

Stage 1: Respondents Established Grades

Each respondent specified his or her desired grade A and grade B product by completing the form shown in figure 2 for each proposed grade.

The results of the survey for the grade A and grade B products are summarized in table 1.

A total score for the grade A and grade B products was calculated by summing the scores for each of the six fillet characteristics that defined the grades. The score for each characteristic was found by multiplying the average score for overall product consistency by the average acceptability of the characteristic. Hence, the difference in scores between grades resulted from using the average acceptability scores at the 95 percent consistency level for grade A versus the 85 percent consistency level for grade B. The difference between total score for each grade was then used to explain the difference in estimated break-even prices determined from the hypothetical market experiment described below.

Stage 2: Hypothetical Market Experiment

The hypothetical market experiment provided information that identified the individual contributions of firm attributes and product characteristics to firm profitability. By

The Pacific whiting industry is concerned with developing grading standards for frozen fillet products that will meet our customers' needs and requirements. You can help us by defining a grade A and grade B standard for Pacific whiting frozen fillets. Below are two identical listings of quality characteristics. Please indicate which options of the quality characteristics would best describe your definition of a grade A and grade B Pacific whiting frozen fillet product by circling one option per quality characteristic for both the grade A and grade B standards.

OVERALL PRODUCT QUALITY CONSISTENCY	a) 99% d) 70%	b) 95% e) 50%	c) 85% f) Other
TEXTURE	a) Firm	b) Moderately firm	c) Soft
FLESH COLOR	a) White	b) Off-white	c) Light pink
SHELF LIFE	a) 18 months	b) 12 months	c) 6 months
APPEARANCE DEFECTS (bruising, blood spots, etc.)	a) None	b) Slight 1-3 defects	c) Moderate 4-5 defects
WORKMANSHIP (cut/trim imperfections, foreign materials, etc.)	a) Excellent No imperfections	b) Good 1-2 defects	c) Fair 3-4 defects
BONE COUNT (each instance of bone is a piece exceeding 10 mm in length and 0.355 mm in diameter)	a) No bones per 0.5 kg of fish flesh	b) 1-2 bones per 0.5 kg of fish flesh	c) 2-3 bones per 0.5 kg of fish flesh

Figure 2: Survey sheet for grade A standards.

Table 1. Composition of grades as determined by respondents.

Characteristic	Average Grade A	Average Grade B
Overall Product Consistency	96.8%	86.1%
Texture	Firm to moderate	Moderately firm
Flesh Color	White to off-white	Off-white to slightly pink
Bone Count	0.5 bones/lb	1.5 bones/lb
Shelf-Life	12.7 months	9.3 months
Workmanship	Excellent to good (0.8 defects)	Good to fair (2.0 defects)
Appearance of Defects	None to slight (1.8 defects)	Slight to moderate (3.2 defects)

specifying a zero level of profit, we derived a "break-even-price" equation. Using this equation, we determined various break-even prices by specifying different levels of firm attibutes and product characteristics.

In the "market" experiment, respondents scored the profitability of eight products on a scale of -10 (very unprofitable) to +lO (very profitable). The Pacific whiting fillets were assumed to be skinless, off-white, and frozen with the pinbone removed. The factors hypothesized to affect product profitability represented both the characteristics of the firm and the product. The products varied by grade, shelf life, supply availability, price, and texture. Firm-specific factors were annual gross sales, position in the marketing chain, and whether Pacific whiting is among the top three species (in volume) the firm handles.

The proposed equation was estimated using the statistical technique of ordinary least squares, and the results are summarized in table 2. All factors measured were found to have a statistically significant effect on profitability except supply availability.

Variables:	Coefficients	Absolute t-values
Grade (1=A, 0=B)	5.05	4.84**
Price (U.S. dollars)	- 13.63	4.85**
Gross Sales (10=above $55 mil., 9=$35-55 mil., 8=$20-35 mil, etc.)	- 2.19	4.90**
Sector ? (1=first receiver, 0=second receiver)	- 2.37	1.60*
Handle Pacific Whiting? (1=yes, 0=no)	- 4.30	2.94**
Supply Availability? (2 or 8 months)	0.21	1.20
Equation Statistics:	Observations=62 F=9.88 Adjusted R2=0.54	* 90% significant ** 99% significant

Table 2. *Profitability of whiting fillets.*

To examine the effect that each factor has on price, we set profit at the break-even level (zero) and solved the estimated equation for price. Larger firms, represented by annual gross sales, were found to operate at a lower price, presumably because of the ability of larger firms to obtain volume discounts. As expected, second receivers had a higher break-even price because of the additional costs associated with their position in the marketing chain. Firms that have handled Pacific whiting break even at a lower price, presumably because of the historically poor product quality and reputation of Pacific whiting fillets. This tendency is consistent with previous research by Sylvia and Peters (1991), who found that the characteristics of Pacific whiting are perceived to be inferior to those of Argentine and Chilean whiting fillets. Fillet products that had a higher grade or longer supply availability received a higher price because these characteristics were more desirable.

In this analysis, one focus was on the effect on break-even price for fillet grade, given a firm's position in the marketing chain and given whether the firm handles Pacific whiting. For moderately firm fillets with a nine-month shelf life, a five-month supply availability, and purchased by a buyer, the following break-even price equation resulted:

break-even price = 0.93 + 0.37 (grade) - 0.17 (first receiver) - 0.32 (Pacific whiting)

Using the above equation, we calculated several break-even prices. In figure 3, these prices are categorized by whether or not the firm has handled Pacific whiting and by its position in the marketing chain. Notice that the price differentials correspond to the coefficients in the break-even price equation, that is, grade **A** is consistently $0.37 more than grade B.

We were also interested in explaining the price difference of $0.37 attributed to moving from a grade B to a grade A product. The price difference can be calculated by the characteristics that defined each grade using the score differentials shown in table 3. This was accomplished by dividing the price difference by the total score difference to obtain the value of a unit of score. When the unit score value is multiplied by the score differential for each characteristic, of a grade A and grade B product, the value of each characteristic is obtained. This is shown in table 4. For example, the value of texture equals $0.0021 x 19.

Stage 3: Grade Score Optimization

The goal of a firm is to maximize profits by increasing price while controlling costs. Switching production from grade B to grade A

Species:	Buyer:	Prices: Grade A	Prices: Grade B	Prices: Average of Grade A and Grade B
If firm *has handled* Pacific whiting	first receiver	$ 0.81	$ 0.44	$0.63
	second receiver	$ 0.98	$ 0.62	$0.80
If firm *has not handled* Pacific whiting	first receiver	$ 1.13	$ 0.76	$0.95
	second receiver	$ 1.30	$ 0.93	$1.17

Figure 3. Break-euen prices for frozen Pacific whiting fillet

Table 3. Grade scores by characteristics.

Characteristic	Grade A	Grade B
Texture	79	60
Flesh Color	76	52
Bone Count	78	32
Shelf Life	75	49
Workmanship	77	50
Appearance of Defects	77	45
Total Score:	462	287

may generate higher gross returns, but higher costs associated with producing grade A may actually make the product less profitable. If all costs were known, this decision would be straightforward, but many of the relationships between product quality and production costs are not yet established. Therefore, for this preliminary analysis, we assumed different cost functions to illustrate the different production decisions that a firm may face based on varying costs. The unit price is composed of a base price (the estimated grade B price) and a grade score value (the additional revenue received from producing a product with a higher score than a grade B product). The base price was calculated from the break-even equation, assuming that the firms are first receivers (first receiver = 1) and that they handle Pacific whiting (Pacific whiting = 1). The assumptions were made to specify a typical on-shore Pacific Northwest processor. The following linear price equation results:

$$\text{price} = 0.51 + 0.0021(\text{score})$$

The hypothetical cost structures consisted of a base cost and two values associated with the grade score. Production of a higher grade, represented by a higher score, was assumed to increase costs. One grade score had a direct and constant (linear) impact on cost. The other was squared (quadratic) to represent costs that increase as score is increased. Three alternative cost structures were assumed (since actual costs were unknown) to emphasize how their differences affect production decisions.

The results in figure 4 show that different cost structures will influence which grade is most profitable. For example, production of grade A in example 1 would result in a loss of $0.03/lb.; however, production of grade B would generate profits of $0.05/lb. Therefore, for the cost structure given in example 1, production of grade B would be the most profitable. In example 2, both grades could be produced and generate a profit whereas in example 3, only production of grade A will generate a profit. If cost information can be determined, cost equations like those shown in figure 4 can aid in making production decisions.

Table 4. Additional value of Grade A characteristics relative to Grade B.

Characteristic	Value
Texture	$ 0.040
Flesh color	$ 0.051
Bone count	$ 0.097
Shelf life	$ 0.055
Workmanship	$ 0.057
Appearance of defects	$ 0.068
Total additional value:	$ 0.370

SUMMARY

The adoption of QA programs can be used as a mechanism to integrate marketing and production decisions. Responses from the ongoing survey indicate that net weight should conform to the stated package weight, grade A has a significantly higher price because of its more desirable characteristics, and those firms that have handled Pacific whiting in the past scored the hypothetical products lower because of past experience and reputation.

Before QA programs can be developed and implemented for Pacific whiting, market information must be incorporated with cost information into management decisions. The cost information must consider all supply-side issues, including how the fishery is managed. For example, the behavior of fishers will vary in response to regulations that can have important implications on the quality of fish delivered to the processor. Industry must also consider short-run versus long-run planning horizons. QA programs will incur up-front costs, but market benefits in the form of higher prices and increased sales may take a longer

Cost Structures:	Scores	Profits	Production
Example 1: 0.46+0.001(score)+0.000009(score2)	Optimal=60 Grade B Grade A	$0.08 $0.05 $-0.03	Grade B only
Example 2: 0.46+0.0013(score)+0.000005(score2)	Optimal=80 Grade B Grade A	$0.08 $0.05 $0.03	Grade B and Grade A
Example 3: 0.56+0.0005(score)+0.000004(score2)	Optimal=200 Grade B Grade A	$0.11 $-0.05 $0.11	Grade A only

Figure 4. Grade production given alternative cost structures

time to generate, depending on marketing skills, promotional budgets, and the past reputation of the product. A successful QA program must incorporate both market and cost information and be a part of marketing and promotional efforts to expand market opportunities.

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QUALITY ASSURANCE: INTERNAL AND EXTERNAL FINANCING OPPORTUNITIES

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QUALITY ASSURANCE AS A SOURCE OF F1NANCING

Money is many things, but to the entrepreneur money is primarily a conveyor of information. And the essential information about which this person wants to be kept abreast is the level of satisfaction expressed by the consumer. The more money comes in - a steady flow - the better an indication that the firm is satisfying the needs of the consumer.

Information is a word that perhaps is abused today. Let us therefore leave the world of communication and directly enter that of finance. It might sound surprising at first, but this is the reality: the consumer is the primary source of financing for the firm. If the consumer is fully satisfied, the firm will not lack financial resources. Is this not the most significant confirmation of the overriding importance of quality assurance?

Quality assurance then is the ultimate source of financing. Indeed, we shall see that, even setting aside the role of the consumer, quality assurance is a direct and immediate-internal as well as external-source of financing opportunities.

INTERNAL FINANCING OPPORTUNITIES

It does not cost money to achieve quality. Rather, quality pays. It pays back the effort of its implementation, not only in increased consumer satisfaction and therefore a steady stream of incoming funds, but also as an array of cost reductions.

The Number of Refunds Is Nearly Eliminated.

With or without an explicit pledge of refunds, an angry customer does demand refunds and is often accommodated. Refunds are costly, not only for the waste they cause, but because most often they imply the loss of a customer. It is not only the present but the future level of sales that is implicated. Along the same vein, it is also whispered that with quality assurance even the number of law suits is reduced.

The Number of Rejects Is Reduced.

When all that needs to be done over the entire chain of production to assure the quality of the product is indeed done, one of the most evident benefits is the noticeable reduction in the number of rejects. Rejects are costly, not only for the evident loss of value, but also for the loss implicit in the inability to satisfy a potential consumer.

Morale Is Raised.

When refunds are nearly eliminated and the number of rejects is reduced, the morale of the employees is raised. Everyone within the firm, if not within the industry, soon knows of those results and is proud of being part of an outfit that does good work. The financial effects of this by-product of quality assurance might be hard to measure, but people work better and faster if they are proud of their work.

Expenses Can Be Eliminated.

Empire Fish Company, of Gloucester, Massachusetts, was the first seafood producer to implement the details of the quality assurance program developed by the Gloucester Laboratory of the National Marine Fisheries Service (NMFS) during the late seventies and early eighties. Knowledge of the quality of its product spread by word of mouth. The firm soon sold fish throughout the United States, and it did not spend one penny for marketing or advertising campaigns. This is an effect that can be easily quantified. And it does not mean that all marketing and advertising campaigns must be eliminated. Efforts to educate the consumer, for instance, would be highly useful. And financial resources devoted to this purpose could easily be found if the need for traditional marketing and advertising campaigns is reduced or even eliminated altogether.

The Financial Effects of Quality Assurance.

There have been many attempts to quantify each of these fields. See, for example, Crosby

1979, pp. 119-126, or Gorga and Ronsivalli 1988, pp. 180-216. Unless figures are related to each firm, these cost estimates generally tend to have a mere theoretical flavor. But certainly it ought to be part and parcel of the statistical measurements relating to quality control to develop precise information for each firm on these effects. Firms that do take such measurements report consistently positive results. Fredrik Palsson, president of Icelandic Freezing Plants Corporation, put it quite well. As quoted in Bidner 1992, he said: 'We spend an awful lot of money on quality control. It's costly, but we get it back. We're essentially buying consumer confidence through our aggressive quality-control programs," Here only two points need to be made. First, a program of quality assurance redoubles the effects of stringent quality control measures, because it covers not any one firm alone but the industry as a whole; the efforts of each firm are not negated but validated by the efforts of all other firms participating in the program. The second point is that a firm raises money internally by reducing costs and lowering expenditures. Since quality pays, in the microworld of each firm quality assurance is an implicit financing tool.

EXTERNAL FINANCING OPPORTUNITIES

Banks do not need hair-brained schemes. The nation does not need hair-brained schemes. The quality assurance program is a solid program. Another one of its hidden benefits is that it can become an explicit financing tool when put in relation to the outside world of finance. Any financial institution will more readily extend loans - at preferential rates - to firms whose costs are low and whose customers are satisfied.

Armed with this significant tool, it behooves the firm to explore all opportunities that exist in the macroworld of finance. Governmental and nongovernmental avenues have to be explored on a systematic basis. Here I review only a few such avenues.

I place most emphasis on two avenues that are little traveled by the seafood industry and are more often taken in other industries. These two avenues are employee stock ownership plans and access to national credit.

The World of Grants, Loans, and Subsidies

There is an entire world of grants, subsidies, and loans at preferential rates that is worth pursuing, provided one has the time and initial resources to pursue it. This is only another one of the reasons that organization, organization, and organization is so important. It is enough to start reciting the so-called alphabet soup of governmental agencies-such as NMFS, with its Saltonstall-Kennedy funding program; the Economic Development Administration; the Small Business Association, with its Small Business Innovation Research program, administered by various agencies; even the Department of Defense - to realize how many opportunities are there to smooth the path of research and development in todays world of so-called mixed economies. Nor should one neglect local and state governments - and even private foundations. For many good reasons, one might be personally opposed to the existence of such a world, and yet two points need to be made. First, at a very practical level, one must remember that one can be put at a competitive disadvantage if the benefits offered by such a world are left by default to one's competitors. Second, many positive things can be said about effective, well-conceived, and well-managed R&D programs. Many projects might never be undertaken without such assistance; and once successfully undertaken, they function as insurance that the project is viable - hence the rush of applications from which, generally, the entire nation benefits.

The Employee Stock Ownership Plan

The employee stock ownership plan (ESOP) is one of the most important tools that can be used in the process of capital formation. Not unlike cooperatives, it is the only development tool that integrates economic and legal issues. Not unlike cooperatives, it is the only legal tool that addresses in advance the issue of equitable distribution of future ownership of the wealth that is being created. Unlike any other legal instrument, however, the ESOP is the only financing tool that allows for the deduction of principal as well as interest from the taxable burden of the firm. Congress allows for such a unique preferential treatment because, when it is well planned and implemented, the ESOP distributes a considerable number of benefits to all participants to the plan and to society as a whole.

Before looking at these benefits, let us become familiar with the mechanics of the plan itself. The literature on ESOP is vast and continuously growing; an updated reference list is maintained by the National Center for Employee Ownership in Oakland, California.

The Mechanics of the ESOP

The ESOP is a flexible legal instrument that must be designed to fit the particular needs of a specific firm. It is essentially a form of tax-qualified stock bonus plan. Thus the ESOP basically is a deferred compensation plan established for the benefit of all full-time and some part-time employees. The corporation contributes financial resources to this trust as a variable percentage of its yearly covered payroll. At present this figure is about 25 percent per year. It was the genius of Louis 0. Kelso, its designer, however, not to leave this trust fund in a passive state but to conceive of it as an active entity. Thus was born the leveraged ESOP (Kelso and Adler 1958; and Kelso and Hetter 1967). Since the trust fund is fully tax exempt, it is the trust that applies for loans from financial institutions and repays the loans with the proceeds from the yearly contributions to the fund. The assets of the corporation also serve as guarantee of the repayment of the loan.

The Benefits of the ESOP

The benefits that accrue from an ESOP are better observed by singling out the benefits to each participant in the plan.

Stockholders

The stockholders of the corporation benefit from the creation of capital formation in a tax shelter environment. Certainly there is some dilution of their ownership, but this dilution refers to the ownership of future wealth - that wealth whose creation is assisted by the employees and is pursued under a favorable tax treatment. It is society as a whole that pays in the short run through the loss of tax revenues. But society too benefits in the short as well as the long run.

Society

The benefits that accrue to society stem from three major sources. The wealthier the employees become, the higher the individual income taxes they will pay when they withdraw their share of dividends or capital from the plan. And the wealthier employees and retired persons become, the less need they have for all sorts of welfare benefits. Thus, the ESOP tax deferral of today is compensated by the reduction in the welfare burden of tomorrow. The tax deduction is a true investment for the community as a whole. Society will also benefit from the rather immediate result of lower inflationary and deflationary pressures, because employees are more prone to lower their demands for wage increase in periods of inflation and to tolerate a greater level of wage reduction in periods of deflation.

Employees

Certainly employees can buy shares of stock today. But they have generally not done so in the past and are unlikely to do so in the future because to purchase shares of stock requires an amount of money that most employees do not have. With ESOPs, the corporation makes its credit status available to its employees, to borrow money from financial institutions. Employees-aided by tax deferments - in essence use their future profits to repay the loan and become owners of the stock. While at first sight there is only a shift between future wages and future ownership of stock, the changes are more fundamental than that. With the certainty of legal ownership comes a greater willingness to work hard and to see that co-workers work hard.

Stephen Covey (1989) distinguishes between production (P) and production capacity (PC), encourages building a balance between the two, and then (p. 58) points out, "You can buy a person's hand, but you can't buy his heart. His heart is where his enthusiasm, his loyalty is. You can buy his back, but you can't buy his brain. That's where his creativity is, his ingenuity, his resourcefulness.

"PC work is treating employees as volunteers just as you treat customers as volunteers, because that's what they are. They volunteer the best part-their hearts and minds." Employees who use their hearts and minds are more likely to observe and improve upon quality standards than employees who work solely for a wage. ESOPs are an internal insurance that quality standards will be the highest possible - from both a financial and a technological point of view. Is not that the beginning of wisdom concerning quality assurance? As Frank Foley (1981), an elder statesman of the fisheries industry used to say, "Quality fish, quality people."

ACCESS TO FEDERAL CREDIT

While it is true that quality pays, it is also true that - depending on the position from which one starts and the technology one wants to use - quality assurance requires variable investment sums at the outset. The money will

be recovered because consumers are ready to pay a higher price for seafood of assured quality, but the initial outlay is inevitable (Gorga and Ronsivalli 1988, pp. 189-192). Where will the money come from?

The traditional approach is to go to banks and other financial institutions for such funds. Banks and financial institutions then go to their depositors, pay going market rates of interest, and lend the money. This approach has two major limitations: the cost is high, and the availability of funds is generally low.

At times such as the present, such limitations are more severe than at other times. But they are always present. The question is, Is there any alternative to the prevailing state of affairs?

The alternative is this: rather than going literally to collect available savings from depositors and investors, banks and other financial institutions can go to the ultimate source of money, the monetary authority.

In the United States, the monetary authority is the Federal Reserve System. The Federal Reserve System is the ultimate source of money because it is the administrator of national credit: not personal credit or bank credit, but national credit. We individually create our own creditworthiness; we administer it and are responsible for it. So banks - and other financial institutions - are the creators, the administrators, and are responsible for their own creditworthiness. National credit is something different.

National credit is something that is created by all citizens of a country. All citizens contribute to the increase - or decrease - in its value. It is a common good. For additional characteristics, see Gorga 1991. And since it is a common good, it must be administered for the common good. It must be administered for the benefit of all. It cannot be administered for the benefit of a few people.

From this essential characteristic stem three criteria that must be met in the administration of national credit. These criteria were first enunciated in Gorga and Kurland 1987. National credit must be issued (1) for the creation of new wealth only, (2) for the benefit of all, and (3) at cost.

National credit must be used to foster the creation of only new real wealth. It is the creation of new wealth that directly or indirectly benefits all. Therefore, national credit must be issued only for the creation of new wealth. This criterion can also be justified on the basis of numerous other factors. If the issuance of national credit is accompanied by the creation of new real wealth, its creation will not spur inflationary tendencies. By definition, the issuance of national credit does stem deflationary tendencies. Hence new money created for the creation of new real wealth is stable money. By contrast, new money created for the purchase of consumer goods, goods to be hoarded, existing wealth, or simply paper wealth represented by government and corporate equity or debt is inflationary and hence unstable money. National credit must be issued for the creation of only real wealth.

National credit must be issued to benefit all. Again, there are many factors that justify the deployment of this criterion. If everyone benefits, an array of supreme values is set in motion. Justice prevails. The deleterious impact of envy is lessened. The need to satisfy material necessities assumes its proper role: it is placed neither too high nor too low on the scale of human requirements. With justice ruling society and a citizenry exercising a balanced core of values, not only the beneficial forces of the market are reinforced but even those of democracy. When negative forces are in check, positive forces are more liable to manifest themselves. The benefits of "good government" become widespread. Is not this what we all request from the administration of earthly affairs? Once all that is granted, the question becomes, How can the use of such a common good as national credit be administered for the benefit of all? In a society in which the law is supreme, the answer is surprisingly simple: the legal ownership of the wealth created under the wings of national credit must be as widespread among the citizens as possible. It can only be hinted here that, just as there are many forms of cooperatives, so conceptually there is a whole family of ESOPs - such as individual stock ownership plans, consumer stock ownership plans, or general stock ownership plans (see Bureau of National Affairs 1987, pp. 207-208).

National credit must be issued at cost. The Federal Reserve System prides itself on adding from its operations millions of dollars to the national treasury every year. While it is pleasing to hear that there are federal agencies that are concerned with the "bottom line," the making of profit is not an appropriate function of government. As a result, national credit should be issued at cost. From the exercise of this criterion, it follows that the interest rate to be charged on loans that use national credit - even when a premium is charged to insure

against the risk of default - be in the 2 percent to 3 percent range.

The Legislative Authority

The legislative authority to use national credit along the lines pointed out in the previous paragraphs is already in place. In fact, it is part of the original legislation instituting the Federal Reserve System. The intent of the framers of this legislation is made explicit in paragraph 2, section 13 of the Federal Reserve Act of 1913, where it is mandated that the Federal Reserve System be empowered to discount eligible industrial, commercial, and agricultural paper.

The Political Will

The political will is the necessary ingredient that is missing for the use of national credit to become a common occurrence along the lines indicated above. In a democracy, the political will resides not in the politicians but in the people. If the people request that national credit be used in a certain way, it will eventually be used that way. This point is perhaps best clarified with a brief reference to the history of the Federal Reserve legislation.

A Brief History of the Legislation

The legislation on the Federal Reserve System was a product of the reform movement at the beginning of this century, and ultimately it was the outcome of the agrarian movement that was the hallmark of the second part of the last century. The agrarian movement had specific needs. The essential need was for short-term credit to tide over the farmers until the harvest.

A particular economic doctrine, the so-called Real Bills Doctrine, analyzed and codified those needs. But it did not extend the analysis to the needs of society as a whole - an industrial society at that. The needs of the industrial society vary a great deal and range from the overnight draft to the very long term. All those needs have to be accommodated if the national monetary policy is to be successful. The Real Bills Doctrine also placed no limitation on the use of the funds. Presumably, people could borrow money from the banking system for the sole purpose of accumulating supplies in order to jack their prices up exclusively for personal benefit. The third major limitation consisted of the disregard for the public good also from another point of view, the point of view of legal ownership of the wealth created with the assistance of public funds. There was no concern for enlarging the basis of the ownership of wealth and ultimately there was no concern for the very health of the market itself. A pyramidal market system, in which the ownership of wealth is concentrated in a few hands, can easily be toppled by manias, panics, and crashes, to borrow Professor Kindleberger's felicitous phrase.

With such weaknesses inherent in the theory, when the policy was implemented between 1914 and 1925, the results were unavoidably disappointing. The use of the discount window at the Federal Reserve System fell into disrepute, and funds from this source were thereafter only sporadically released (Burstein 1986, pp. 20-22 and 59-60).

There seems to be no reason why the errors of the past cannot be avoided in the future. Certainly, a new policy cannot be tainted by the errors of the past.

CONCLUDING COMMENTS

From the point of view of the consumer, the quality assurance program is a tool to assure the consumer of the quality of the product, purchased. From the point of view of the producer, the quality assurance program is a tool to assure the producer of the financial viability of the product that is produced. Thus the loop is closed; consumers and producers both obtain what they want and what they unquestionably need.

In the long run, the quality assurance program is a tool of internal financing, not only because it lowers costs and expenditures for the firm but also because a product whose quality is assured commands a higher price than any comparable product. In the short run, however, the implementation of the quality assurance program might require considerable outlays of funds. When considering the technical requirements of the quality assurance program, one simply wants to obtain all the best that the technology can offer. As pointed out above, there are three major external sources of funding that need to be explored. One consists of all government programs assisting in the process of capital formation. The second is the use of employee stock ownership plans, since such plans are very well received by the conventional financial world today. The third is the recourse to the discount window of the Federal Reserve System. All three financial tools deserve to be researched, and if any of

them is found appropriate to the particular needs of an individual firm - or group of firms - at any particular time, all steps should be taken to adopt it.

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TILLAMOOK: THE QUALITY TRADITION

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The settlers who populated the Tillamook Valley between 1855 and 1900 had some unique challenges to overcome. There were no roads for commerce. All supplies and cash sales moved by boat. Dairy was the only agricultural effort that was viable. Butter was the only dairy product they knew how to make. And sporadic transportation caused quality problems with customers.

In 1898, Peter McIntosh came to the valley from Canada to make Cheddar cheese. His knowledge of bacteriology and sanitation taught Tillamook dairy farmers how to make a good quality product that would withstand the variable delivery schedules.

Early dairy production was by private operators in competition with each other, but by 1909 many of them were operating as cooperatives, and Carl Haberlach, a young attorney, convinced ten of these small cheese plants to contribute $25 each and form a marketing cooperative. The Tillamook County Creamery Association was born.

Cheese, bearing the Tillamook brand on the rind, was sold throughout the west, but customers soon recognized a variation in the cheese from different factories and began to express their preference, affecting sales.

The most successful cheesemaker, Fred Christenson, was selected by Haberlach and approved by the cooperative's board to work with each cheesemaker to improve the quality and consistency of Cheddar cheeses carrying the Tillamook brand.

Soon, Christenson and the other cheesemakers recognized that even if everything was done properly at the factory, many vats of cheese were less than desirable because milk coming from the farm was variable, from good to lousy.

Back to the board again, this time to hire a fieldman, Guy Ford, to work with the more than 800 dairy farmers, many of them milking only two or three cows. Some of the items that became important to the inspector were cooling milk after night milking, washing milking buckets every day, having milking pails tinned to remove rust, testing for flavors and sediment at the factories, and rejecting milk not meeting standards

Quality soon began to show up in sales and, as sales improved, so did the price. As the price inched upward, it was possible to return a modest premium to the dairy farmers. Economics were established as a quality incentive by instituting a penalty system for substandard production. Many dairy farmers of marginal quality were encouraged to improve their practices or turn to other methods of earning a living.

In the decade between 1940 and 1950, most dairy farmers were forced to work at construction or lumber mill jobs to help support their dairies. Quality continued to improve from 1960 to 1970 as science taught dairy farmers more about controlling bacteria. Dairies continued to get larger and more advanced, and most dairy farmers now devoted all their time to the farm. Management practices improved as the grade A fluid milk market became a lucrative prize for those who could meet the more rigorous facility, equipment, and management requirements. A general attitude in the industry was that "manufacturing," or "cheese," milk did not need to meet the same standards. This was not the feeling at Tillamook, where the same level of quality was expected for cheese as for fluid milk. Some other cheese manufacturers in the Northwest failed to recognize that top-quality milk was essential for the production of top-quality cheeses. These companies are no longer a force in the marketplace.

In the 1980s, Tillamook's board implemented an aggressive incentive plan that provided a premium to dairy farmers who attained a higher level of quality. At that time, the company average for somatic cell count (SCC) in milk was 400,000 per milliliter. Bonuses of up to 25 cents per hundred pounds of milk were offered to dairy farmers who would reduce their SCC count to less than 100,000. Few farmers felt that such a low number was attainable. Yet, within months, test results indicated a significant improvement in herd health, with company average results dropping below 200,000 and as many as 50 of the Tillamook County Creamery Association's dairy farmers attaining the less than 100,000 goal.

Today, the quality heritage is a major part of Tillamook's message. We are unique in the close contact our field staff has with the dairy farmers. Nearly all of the dairies are located within a 30-mile radius of the plant, with two-thirds of them less than 10 miles away.

This allows daily contact with any dairy farmer who experiences quality problems, and it allows the milk to be transported quickly to the plant for daily processing. Our facility, which operates 365 days a year, processes virtually all milk the same day it is produced.

With the emphasis on quality have come some pleasant benefits. Tillamook products do not use any preservatives for extending shelf life. Vacuum packaging, or the lack of oxygen, is the only mold inhibitor used in storage of cheese. Heat treating of the milk, but not pasteurizing it, allows many beneficial enzymes to remain in the cheese, imparting the special Tillamook flavor and body.

All Tillamook cheese is aged over 60 days before final preparation for sale. Quality assurance tests at this point, and lactic acid development, gives double protection from postpasteurization contamination, which has been the source of illnesses in some cheeses that are manufactured and sold without proper aging.

Lush green pastures, pristine streams, a moderate climate, and isolation from urban pollution all contribute to the Tillamook mystique. Furthermore, with the 1949 opening of the large plant on Highway 101, north of Tillamook, visitors began asking if they could view the cheesemaking process. At first, groups were ushered through the plant, but as numbers swelled, sanitation and safety became more of a concern, and a viewing area was constructed.

Since 1968, interest in this area has grown steadily. Now more than 800,000 visitors a year stop by to view production, browse in the gift ship, or indulge themselves with one of more than 650,000 ice cream cones served up each year. This volume of visitors rates as the third highest in Oregon, according to the Oregon Department of Transportation.

As potential customers view the actual production and packaging of Tillamook cheese, the messages of quality and care are reinforced. An example of the effectiveness of these messages is the public acceptance of Tillamook ice cream throughout the Northwest. As more and more visitors sampled Tillamook ice cream at the plant, they asked why it was not available in the grocery stores back home. Even though we had produced it since 1949, ice cream was sold only locally until three years ago when we embarked on a distribution plan for Tillamook ice cream that has already placed 6 of the top 10 selling flavors of premium ice creams in Oregon, according to Info Scan, a market sales reporting service. The message is clear: quality is a product that cannot be oversold.

THE QUEST FOR QUALITY: NEW FRONTIERS IN SEAFOOD MARKETING

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Consumer concern over seafood safety has made quality assurance programs a fact of life for the seafood industry. Gone are the days when simply having a quality assurance program sharpened your product's competitive edge. Today, quality assurance programs are a necessary part of doing business. The distinguishing factor is how you market your quality assurance program, how you let consumers, the trade, and business partners know how your program assures them of a safe, high-quality product. Creative, strategic marketing of your quality assurance program can greatly influence the perception of your product and its perceived value.

To illustrate the state of the art in innovative marketing of quality assurance programs, I present case studies of three marketing associations: the Association of Chilean Salmon Farmers, the Maine Department of Marine Resources, and the Alaska Seafood Marketing Institute. These, along with others, are organizations that are breaking new ground in making the most of their quality assurance programs.

ASSOCIATION OF CHILEAN SALMON FARMERS-QUALITY ASSURANCE IN TODAY'S COMPETITIVE MARKETPLACE

When the Association of Chilean Salmon Farmers formed in 1986, it faced a very competitive marketplace. The world knew little about Chile in general and even less about its fledgling salmon farming industry. Given the high quality of product produced in Europe, primarily by the market leader, Norway, the Chileans realized that a successful entry into the world market depended on guaranteeing this high quality themselves.

With this in mind, the association set out to ensure that all salmon raised by its members was harvested, processed, packed, and shipped at the highest level of quality. The association adopted a code of quality standards and an independent inspection process that rank among the most rigorous in the world. This quality assurance program has been marketed aggressively, becoming a "competitive edge" for Chilean salmon and contributing to the rapid rise in global demand for the Chilean product. Japanese seafood buyers, who are among the world's most selective, purchased over 28,000 metric tons of Chilean salmon in 1992.

Brief Outline of the Association's Quality Assurance Program

The association's quality assurance program is based on a set of rigorous guidelines for plant construction and sanitation, worker hygiene, equipment specifications and sanitation, and processing standards. The program also includes specific product characteristics for each species of salmon produced in Chile, along with descriptions of the characteristics for each grade of product. To give the program real teeth, the association requires that quality control inspectors from independent certifying agencies supervise all inspections.

The process begins at the point of harvest, where inspectors check the salmon for size, shape, appearance, and overall health according to the code's criteria.

Inspectors are also present during processing, making sure the fish are headed, gutted, and cleaned under exceedingly sanitary conditions. After processing, inspectors grade the fish, rejecting those salmon not meeting the association's standards. Fish that pass inspection are iced and packed for export with the Association of Chilean Salmon Farmers' seal. This seal, the centerpiece of the association's program, is given only to fish that have been processed in a certified plant by an independent inspector and have been classified as Premium or Grade 1 quality.

The fish are also inspected once they reach the Santiago airport, before being flown fresh to world markets. At this checkpoint, product temperature and the condition of the ice and packaging come under the inspector's scrutiny.

These final inspectors also pay close attention to elapsed processing time - the time that

has passed from leaving the water to shipment. Again, if the fish do not meet the approval of the inspectors, they are not shipped.

In 1992, the association expanded its inspection manual to include regulations for the technical requirements and sanitary conditions in each salmon processing plant. The manual now specifies plant code regulations for wall and floor coverings, processing tools, clothing, gloves, and masks. The association also developed individual quality standards for each species of fish raised in Chile.

Each year, the association organizes a symposium to review its quality standards. Improvements are made on the basis of past experience and new techniques.

Marketing the Program

The association has made its quality assurance program one of the cornerstones of its strategic positioning. All elements of its marketing program reinforce the quality assurance message to educate buyers, consumers, and the trade.

The quality seal itself serves as the primary marketing tool. The seal is a visual reminder of the quality assurance program and a guarantee that the product has met its high standards. As well as appearing on inspected product, the seal has been used as a graphic element in trade advertising. Trade advertising copy always incorporates the quality assurance message. Here is a quote from the association's current trade ad:

> In this land of unspoiled beauty, each and every salmon is hand-raised, painstakingly tended, and processed according to the most exacting standards in the world.
>
> There's a difference, too, in the way Chilean salmon is packed and shipped, so it arrives at its destination as fresh as the moment it left the water.

Public relations is another way the association gets the word out about its quality assurance program. The association's press kit includes a two-page release that outlines the inspection program in detail. And all other press materials incorporate the quality assurance message.

The association's quarterly newsletter, The *Chilean Salmon Farmer's Almanac,* also strategically markets the program to importers and buyers from retail and restaurant chains. Each issue includes an article on the quality or the safety of the product. Recent headlines include, "Chilean Salmon: A Safe Choice" and "Chile Toughens Already Strict Inspection Standards."

One of the association's most successful marketing efforts was the January 1992 Food Editor's Tour of Chile. The tour aimed to educate consumers and the trade about the quality assurance program by showing them firsthand how it works. Food editors from a dozen national consumer broadcast and print media, including *Better Homes and Gardens, Woman's Day, Good Housekeeping, McCall's, House Beautiful,* and *Ladies Home Journal,* participated in the tour. The editors travelled to the salmon-growing region in the south of Chile to visit salmon farms and processing plants. The tour resulted in numerous articles and broadcast coverage, all stressing the association's quality assurance messages. The tour won a 1992 Seafood Business Marketing Excellence Certificate of Merit,

By strategically marketing its quality control system, the association has successfully built the reputation of its product in key markets, allowing it to develop from a relatively unknown producer of farmed salmon in 1986 to the second largest producer of farmed salmon in the world today.

MAINE DEPARTMENT OF MARINE RESOURCES: MAINE FRESH GROUNDFISH QUALITY CONTROL PROGRAM--START SMALL AND GROW

The Maine Department of Marine Besources' Maine Fresh Groundfish Quality Control Program developed 10 years ago out of a pilot program which had as its goal to develop a "Maine identity" for groundfish while responding to consumer quality and health concerns. At the time, the state had little in-state processing; instead, whole fish were shipped to the Boston area where they were sold as "Boston" or "New England" fish.

The department established a set of Standards based on the federal grade A program, which provides for a consistent level of quality and extends the shelf life of the product. Fish meeting the criteria received the "Maine Certified" logo. As with the Chileans, the Maine logo became the cornerstone of all marketing efforts. According to a Department of Marine Resources representative, studies have shown a strong Iink between the perception of quality and a seal or stamp. The Maine logo not only

provides this association with quality, but backs it up. They have built their program by implementing tough standards, working closely with the state's processors to enlist industry cooperation, and then creatively marketing these standards nationwide.

"In the Beginning"-Creative marketing to the Supermarket Industry

Maine adopted a marketing program that was more narrowly focused than that of the Chilean salmon farmers. To introduce their new logo, the department developed a Pilot project targeted to supermarkets. Two processors and two chain supermarkets, Shop and Save and Shaw's, agreed to participate. The supermarkets each sold the Maine label in six stores in the Portland, Maine, market. The department developed recipe brochures to display near the product in the stores. Clip-on tabs with the logo were also attached to the price tags in the display case so that consumers could immediately identify the Maine certification. The initial pilot program was intended to run for six months, but after only 14 weeks it had become so successful that both chains extended it into all of their stores.

Based on the success of the pilot program, the department set up a full-blown supermarket campaign, putting their own representatives in the stores to help supermarket personnel improve sanitation and increase product shelf life. The department helped write individual company manuals, developed on-site training programs, and conducted free seminars if a store agreed to purchase the Maine product exclusively.

As the Maine product made its way into metro New York supermarkets, the department found their in-person training efforts strained because of the high turnover of supermarket employees. Tbis inspired the department to create a video retail training program consisting of four videos: identifying quality product; setting up and sanitizing a cooler; sanitizing, icing, and setting up a full-service case; and merchandising product. Since its development, many companies have purchased this program. Through its videos and training programs, the Maine department quickly established itself as the expert in quality assurance at the supermarket level.

The industry has recognized Maine's achievements. The Maine program was given a top prize in the Seafood Business Marketing Excellence Awards.

ALASKA SEAFOOD MARKETING INSTITUTE—MARKETING INSIDE OUT

The Alaska Seafood Marketing Institute's (ASMI) quality control marketing program differs from my first two case studies in that it focuses on internal marketing - educating those involved in the harvesting and processing of Alaska seafood.

ASMI has developed species-specific handling guidelines for fishermen, tender operators, processors, cold storage facilities, and distributors, with the major emphasis on fishermen and processors. These recommendations are "sold" through videos, workshops, brochures, trade shows, and conferences.

Having enrolled the cooperation of fishermen in quality assurance, ASMI backsells their participation and expertise to seafood buyers. As an example, here is a line from a recent ad for Alaska Halibut: "And the quality is ensured by the experience and expertise of the Alaskan fishermen who catch it."

Currently, ASMI also has an advertising campaign in *Seafood Leader* that aims to educate retailers about quality assurance for the Alaska product. The campaign advertises a series of training videos for retail employees that focus on maintaining seafood quality in a retail environment.

TEN TIPS FOR MARKETING YOUR QUALITY ASSURANCE PROGRAM

The Association of Chilean Salmon Farmers, the Maine Department of Marine Resources, and the Alaska Seafood Marketing Institute each offer examples of creative strategies for marketing a quality assurance program. Clearly though, each group has a different target market and different marketing objectives and therefore employs unique tactics. Some of these you might have found potentially applicable to your group-others not.

I would like to close by giving some tips that are generally applicable, what I call my "Ten Tips for Making the Most of Quality Assurance Marketing."

1. Quality assurance is no longer the exception. It's the rule.

Given the seafood safety issue, especially in the United States, a good quality assurance program is a necessary part of doing business in the seafood industry today.

2. You can't market what you don't have.

Make sure that your quality assurance program is in place and running well before marketing it. False starts make your marketing job much more difficult.

3. Make sure your team knows the score.

Develop and clearly articulate your position on customer safety and product quality. Then, make sure everyone in your organization knows about it and subscribes to it.

4. Get a handle on handling complaints.

Marketing your quality assurance program will heighten the expectations of your customers. Be sure you have a response mechanism in place to handle any complaints that come up quickly and effectively.

5. Start small and grow.

If you have a limited marketing budget, use it to do a few things well. Then expand your program from there.

6. Don't forget your customer's customer.

For real impact, market your program up and down the distribution chain. If your buyer's customer believes in your quality assurance program, then that's added value.

7. Quality assurance doesn't stop with you.

Your quality assurance job doesn't end when the product leaves your door. Follow-up to make sure your product is well handled by those who transport and handle it. And build into your marketing plan the time and budget to educate your customer about how to maintain the quality of your product.

8. Make your package count.

By placing your quality assurance message directly on the package, you are saying something about what's inside. Don't forget to repeat your quality assurance message in all of your marketing communications.

9. Beware of the words "high quality."

Everyone uses the words "high quality" and soon everyone will be touting their latest quality assurance program. You must find ways to communicate how your program is different.

10. Tell the world your story.

Work with the trade and consumer media to get the word out about your quality assurance program. These "third-party" endorsements are invaluable in establishing a favorable reputation for your product.