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 ISO 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 ISO 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 ISO 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?
### 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 timeframe 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

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### Figure 1. 
*Implementation planning matrix.*

### Table: Company Procedure

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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.
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 JASANZ (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.](image)

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

Ron Williams
Shore Trading, Inc., Roswell, Georgia

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-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
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
- Partnership development - 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.

<table>
<thead>
<tr>
<th>Importance</th>
<th>Product Safety</th>
<th>Regulatory Compliance</th>
<th>Product Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>System</td>
<td>Mandatory</td>
<td>Required by Law</td>
<td>Voluntary</td>
</tr>
<tr>
<td>Type of Control Point Required</td>
<td>HACCP</td>
<td>Critical Control Point (CCP)* or Control Point (CP)</td>
<td>Quality Control</td>
</tr>
</tbody>
</table>

* 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.

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
Table 2. Sequence of organizational events and actions necessary for implementation of the HACCP system in a food facility.

<table>
<thead>
<tr>
<th>Organizational Management</th>
<th>Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>HACCP coordinator and core HACCP team</td>
<td>* Policy</td>
</tr>
<tr>
<td>Product teams</td>
<td>* Objectives</td>
</tr>
<tr>
<td>Line operators</td>
<td>* Appoint HACCP coordinator</td>
</tr>
<tr>
<td>Management and core HACCP team</td>
<td>* Train coordinator and team</td>
</tr>
<tr>
<td>* Develop HACCP project plan</td>
<td></td>
</tr>
<tr>
<td>* Develop initial HACCP plan</td>
<td></td>
</tr>
<tr>
<td>* Appoint product teams</td>
<td></td>
</tr>
<tr>
<td>* Conduct training for teams</td>
<td></td>
</tr>
<tr>
<td>* Assist product teams</td>
<td></td>
</tr>
<tr>
<td>* Develop product HACCP plans</td>
<td></td>
</tr>
<tr>
<td>* Develop operator procedures</td>
<td></td>
</tr>
<tr>
<td>* Plan operator training</td>
<td></td>
</tr>
<tr>
<td>* Conduct trial test runs</td>
<td></td>
</tr>
<tr>
<td>* Help line operators start HACCP</td>
<td></td>
</tr>
<tr>
<td>* Monitor individual CCP</td>
<td></td>
</tr>
<tr>
<td>* Take corrective action</td>
<td></td>
</tr>
<tr>
<td>* Do most record keeping</td>
<td></td>
</tr>
<tr>
<td>* Help improve system</td>
<td></td>
</tr>
<tr>
<td>* Verification</td>
<td></td>
</tr>
<tr>
<td>* Update and revise HACCP plan</td>
<td></td>
</tr>
</tbody>
</table>

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).
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

<table>
<thead>
<tr>
<th>Step</th>
<th>Identified Hazard(s)</th>
<th>Preventive Measure(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw fish</td>
<td>Potential: microbiological, chemical, and physical hazards</td>
<td>Establish and enforce specifications for receipt of raw fish</td>
</tr>
<tr>
<td>Inspection</td>
<td>Metal contamination</td>
<td>Metal detector</td>
</tr>
<tr>
<td>Cooking</td>
<td>Survival of hazardous microorganisms</td>
<td>Correct cooking procedure (such as time and temperature of the cook)</td>
</tr>
<tr>
<td>Trucking</td>
<td>Temperature abuse and growth of hazardous microorganisms</td>
<td>Chill truck to &lt; 35°F before loading; monitor compartment temperature</td>
</tr>
<tr>
<td>Retail display</td>
<td>Temperature abuse and growth of hazardous microorganisms</td>
<td>Maintain product in refrigerated food case at &lt; 40°F; do not exceed shelf life.</td>
</tr>
</tbody>
</table>

* 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.

### CCP Number

<table>
<thead>
<tr>
<th>No. 1: Adherence to purchase specifications</th>
<th>Monitoring</th>
<th>Corrective Action</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Comply: each lot</td>
<td>If not in compliance: reject lot</td>
</tr>
<tr>
<td>No. 5: Metal detector</td>
<td>Continuous</td>
<td>If metal detected:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>* Stop line and correct cause.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>* Hold food and dispose of safely.</td>
</tr>
<tr>
<td>No 11: Cook time and temperature for food (one minute @ XXX°F)*</td>
<td>Continuous: time and temperature recorder</td>
<td>If low time or temperature:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>* Stop cook and correct cause.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>* Immediately recook or hold and dispose of safely.</td>
</tr>
<tr>
<td>No. 21: Precool refrigerated trucks to 4.4°C before loading product</td>
<td>Before each load</td>
<td>If truck temperature is above 4.4°C: Do not load truck until it is cooled to 4.4°C.</td>
</tr>
<tr>
<td>No. 22: Retail product temperature 4.4°C and shelf life</td>
<td>Each week</td>
<td>If temperature exceeds 4.4°C or if shelf life is exceeded:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>* Work with store to lower temperature.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>* Remove product.</td>
</tr>
</tbody>
</table>

*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).

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**Figure 1.** Examples of the results of a hazard analysis for fish fillet production.

**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?

**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?

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**Figure 3. Guide for preparing operator procedures for monitoring for one critical control point.**

Figure 4. Guide for preparation operator procedures for corrective action when monitoring indicates that the CCP is out of control and a safety hazard may exist.

warming 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

John Clemence
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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.
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 be 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, stop 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, PhD 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

Carmine Gorga
Politics Incorporated, Gloucester, Massachusetts

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 make. 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. Ronisivalli 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.

REFERENCES

Measuring and Controlling Seafood Quality
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's 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? Why 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.
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 10-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

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the degree of retention. Nine analysts participated, three from each agency. Samples were presented in sets of 15 with 15-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 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 adenosin (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.