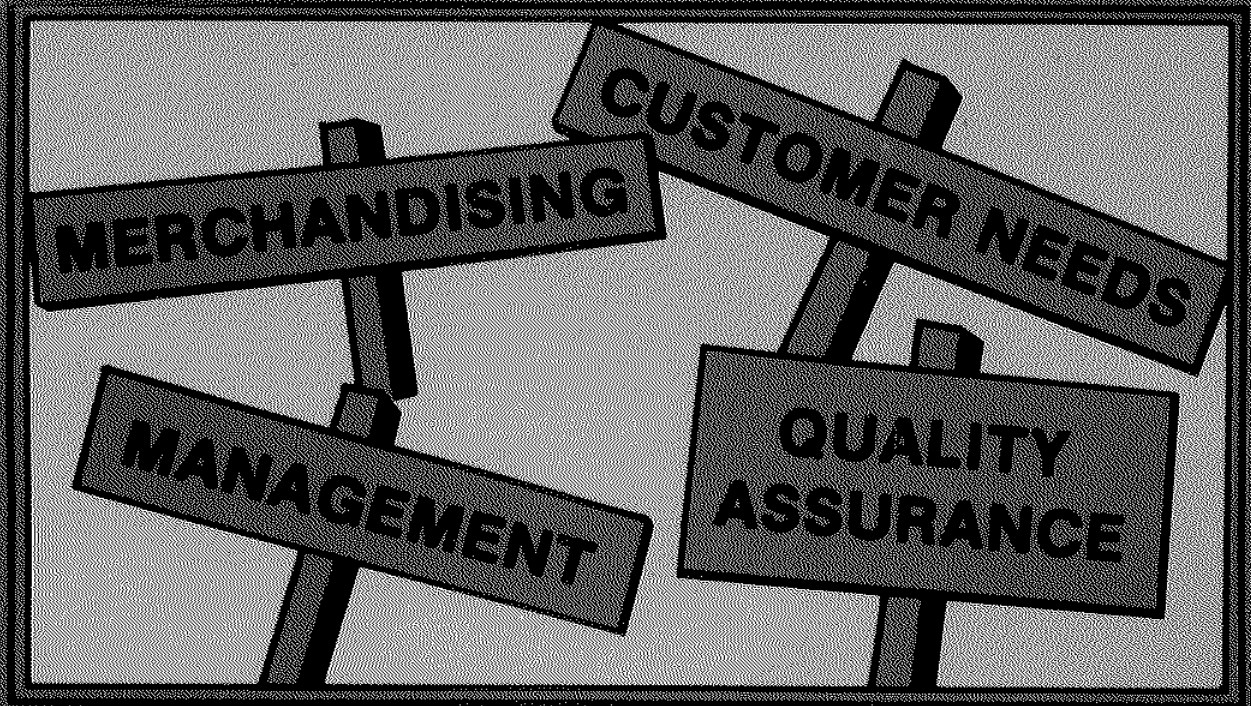


MARKETING GUIDELINES

for a

RETAIL SEAFOOD DEPARTMENT



Sea Grant at Virginia Tech



**Mid-Atlantic Fisheries
Development Foundation, Inc.**



**National Marine
Fisheries Service**

**MARKETING GUIDELINES FOR A RETAIL SEAFOOD DEPARTMENT:
CUSTOMER NEEDS, MANAGEMENT, QUALITY ASSURANCE AND MERCHANDISING**

SPONSORS

VIRGINIA TECH, VIRGINIA COOPERATIVE EXTENSION
SERVICE, AND VIRGINIA SEA GRANT
BLACKSBURG, VIRGINIA

MID-ATLANTIC FISHERIES DEVELOPMENT FOUNDATION, INC.
155 DEFENSE HIGHWAY, ANNAPOLIS, MARYLAND 21401

NATIONAL MARINE FISHERIES SERVICE, WASHINGTON, D. C.

VPI-SG-88-01
May 1988

VSG-89-05

**MARKETING GUIDELINES FOR A RETAIL SEAFOOD DEPARTMENT:
CUSTOMER NEEDS, MANAGEMENT, QUALITY ASSURANCE AND MERCHANDISING**

The Purpose of Marketing Guidelines

These seafood marketing guidelines are designed to enable food retail buyers, merchandisers, managers, and owners to assess their needs in effectively marketing seafood in a retail department. The guidelines are intended for the busy executive or manager who must grasp the overall concerns of operating a seafood department. To expand on these guidelines detailed information about departmental operations is contained in the appendices.

The material content of the book focuses on a systems approach to managing a seafood department: 1) the customer, 2) a management program, and 3) the operational aspects of the department. The notion of profitability is woven into each section with emphasis on the systems approach.

An educational program for retail workers may be developed from the materials. The materials are not copyrighted and may be adapted to in-store training programs conducted by retailers.

Charles W. Coale, Jr. (703) 961-5562
Thomas E. Rippen (804) 247-2061
George J. Flick (703) 961-6965
Virginia Tech
Virginia Sea Grant
Blacksburg, VA 24061
May 2, 1988

PUBLICATION AUTHORS

Charles W. Coale, Jr., Professor of Agricultural Economics, and Extension Economist, Virginia Tech. Dr. Coale's area of interest include strategic and operational planning in food and seafood marketing. He has cooperated with Virginia Tech faculty and staff in conducting comprehensive seafood marketing programs in the Virginia Sea Grant Program.

Donna Soul Boone, Extension Specialist, Virginia Tech Seafood Experiment Station. She works with professional home economists, retailers, and the seafood industry to supply them with seafood information. This information includes species identification, handling seafood, nutrition and health concerns about seafood and preparation. Mrs. Boone joined the Virginia Tech Food Science faculty in 1985.

George J. Flick, Professor of Food Science, Virginia Tech. Dr. Flick's specific field is chemistry, technology, and microbiology of seafood products. His extension and research interests focus on the utilization of marine food resources. He developed and teaches a course in Marine Food Products.

Michael G. Haby, Extension Seafood Marketing Specialist, Texas A&M University. Mr. Haby has worked with the seafood industries in New York, Virginia, and Texas. His major interests in seafood marketing are developing alternative marketing channels for seafood and retailing underutilized fishery products.

Cameron R. Hackney, Associate Professor of Food Science, Virginia Tech, and Superintendent of Virginia Tech's Seafood Experiment Station. Dr. Hackney's research and extension activities have focused on food safety, quality maintenance, processing microbiology, and utilization of marine food resources.

Don L. Long, Professor Emeritus of Agricultural Economics, Virginia Tech. Dr. Long has authored and co-authored several nationally recognized management books and materials and has conducted numerous workshops for managers of agribusiness and food distribution firms, including seafood companies. He is the architect of the Job Analysis Chart contained in this book.

Thomas E. Rippen, Marine Extension Agent, Virginia Tech/Virginia Sea Grant. Mr. Rippen assists the seafood industry with processing and marketing concerns. His activities include evaluation of handling procedures, training of retailers and educators, computer applications and development of educational materials.

Donn R. Ward, Extension Coordinator, Food Science, North Carolina State University. Dr. Ward's extension and research interests focus on seafood quality maintenance and quality determination, as well as utilization of marine food products.

VIRGINIA TECH SEAFOOD ADMINISTRATIVE STAFF AND ADVISORS

E. N. Boyd, Associate Director, Virginia Agricultural Experiment Station, Virginia Tech. Dr. Boyd is the Administrator of the Virginia Tech seafood program and the University representative to the Office of Sea Grant. His academic training centers in food science.

Sandy Bridgman, Advisor to the Project. Mrs. Bridgman is an account executive for the Waters Advertising Agency. Mrs. Bridgman has worked with the Virginia Seafood Council and with program development and liaison with the Mid-Atlantic Fisheries Development Foundation, Inc.

Weston Conley, Seafood Processor and Marketer. Mr. Conley is the co-chairman of the Virginia seafood marketing program. He is the owner of RCV Seafoods, Inc., which processes and markets crabmeat products and oysters.

Mitchell Geasler, Vice Provost and Director of the Virginia Cooperative Extension Service, Virginia Tech. Dr. Geasler is the administrator for the Virginia Cooperative Extension Service.

George H. Harrison, Seafood Marketer. Mr. Harrison is the co-chairman of the Virginia seafood marketing program and is the owner of Sea Pride, Inc., which procures and markets 300 different species of fish and shell fish.

Kerry Muse, Executive Director, Mid-Atlantic Fisheries Development Foundation, Inc., Annapolis, Maryland. Mr. Muse has provided leadership for seafood marketing in the Mid-Atlantic region of the United States and funding to complete this project.

Ann Sanderson, Mrs. Sanderson is Director of the Northeast Extension District in Virginia. Mrs. Sanderson serves on the Virginia Tech Seafood education and advisory council.

Gerald Spittle, Manager of Microcomputer Laboratory, College of Agriculture and Life Sciences, Virginia Tech. Mr. Spittle has provided computer programming support and advisement.

Clinton V. Turner, Director of the Cooperative Extension Service, Virginia State University. Dr. Turner has served as Northeast District Director for Extension and has served on the Virginia marine advisory and educational council.

George Washington, President of Mid-Atlantic Fisheries Development Foundation, Inc., Annapolis, Maryland. Mr. Washington has served as industry liaison between Virginia watermen and the Virginia Tech educational programs, and has arranged watermens demonstrations for the Virginia Seafood Marketing Program.

CONTENTS

The Purpose of Marketing Guidelines.....	ii
Publication Authors.....	iii
Virginia Tech Seafood Administration Staff and Advisors.....	iv
1. The Seafood Consumer.....	1
Trends.....	2
The Customer Purchase Decision Process.....	4
Substituting Finfish.....	5
Seasonal Availability.....	7
Seafood Cookery.....	8
Ten-Minute Rule.....	8
How to Eat a Pan-Dressed Fish.....	9
Nutrition.....	11
Fish Oils: Omega 3.....	12
2. Management of the Seafood Department.....	15
Planning Management.....	16
Areas of Management Responsibility.....	17
Product Margin Management.....	20
3. Quality Maintenance and Merchandising.....	31
Customer Satisfaction.....	32
Safety / Liability.....	32
Product Shrink.....	34
Quality Criteria.....	36
Recommendations for Handling Seafood.....	39
Retail Display Cases.....	42
Seafood Other than "Fresh" Products.....	44
Smoked Seafood.....	44
Surimi.....	46
Pasteurized Crabmeat.....	48
Frozen Seafood.....	49
Value-Added Products.....	54

Appendices

I. The Purchase Decision Process.....	61
II. The Seafood Department Manager Supervisor and Evaluation.....	77
III. Definitions for the Margin Management Spreadsheet.....	85
IV. Perishability of Seafoods / Procurement / Record Keeping.....	87
V. Sanitation.....	99
VI. Packaging.....	103
VII. Value-Added Products: A Shelf-life Study.....	109

THE SEAFOOD CONSUMER

Know your customers. Consumers depend on the seafood department for information about selection, substitution, seasonal availability, preparation, even nutrition. Their needs will vary and this variation is reflected in their buying habits.

It behooves the retailer to be knowledgeable about customers' concerns. Many customers will fall into a pattern of buying just one species of fish and always preparing it in the same way. Being prepared to suggest species substitutes, a new recipe or a different cooking method may be just the encouragement a customer needs to try something new.

Consumers are concerned about seafood freshness and how to select good quality products. In addition, many consumers are unfamiliar with the variety of species available to them. They are very interested in learning the flavor and textural characteristics of these unfamiliar species and the health benefits of seafood.

The Customer Needs section is designed to provide the retailer with many of the answers to consumers' questions. Much of the material can be reprinted and used as point of purchase material.

TRENDS

- ▶ The health conscious 80's! Consumers are more aware of their diets and their health than they were in the past. Many consumers are reducing their cholesterol and fat intake either by choice or necessity. Seafood is low in calories, fat, cholesterol and sodium, which is how it gained the well-deserved reputation as a healthy food. A fat compound, called omega 3, found primarily in marine products is one of the main reasons for seafoods' new claim to fame.
- ▶ Seafood is convenient to prepare, and as more consumers learn about seafood preparation, more of them will be buying fresh seafood.
- ▶ The 1986 per capita seafood consumption was 14.7 pounds, a 42 percent increase over the 1960 figure of 10.3 pounds. Per capita consumption topped 15 pounds in 1987. The fastest increases have been seen in the 80's. This trend is expected to continue for the next few years. ¹
- ▶ Skinless-boneless fillets seem to be more in demand today. This trend is in keeping with the convenience factor of seafood. Consumers want to spend minimal time in preparation. In addition, they do not want to be bothered by the bones or skin of the fish.
- ▶ Full-service seafood departments are also on the increase. In 1987, 71 percent of the fresh seafood sold was purchased from the full-service counter. This was a 24 percent increase over 1985. ² Several factors may play a role in the trend. The personalized service may reduce the customer's perception of risk by instilling confidence. This "one on one" contact offers retailers an opportunity to familiarize customers with new products, species substitutions, preparation methods, purchasing tips, etc. Note, however, that some highly successful self-service programs exist and should continue to have advantages for certain retail programs.
- ▶ There is a much larger variety of fresh seafood available worldwide than ever before. Improvements in transportation and refrigeration have decreased shipment times, thus

¹1987. Retail Seafood Study. Food Marketing Institute and the Gulf & South Atlantic Fisheries Development Foundation, Inc.

²Hellevig, Bonnie. 1988. Annual Supermarket Survey. Seafood Business. Vol. 7, No. 2.

providing retailers with a broader product mix and, in some cases, a higher quality product.

- ▶ The importation of seafood has been necessary to accommodate the increased demand in the United States. It is unlikely that domestic supplies of wild fish will increase substantially in the future.
- ▶ Aquacultured (farm raised) products now comprise an increased proportion of the world's supply of seafood. It may offer the seafood buyer a more consistent product. The top three are either totally or in part farm raised. They are shrimp, salmon and catfish.³
- ▶ The number of "further processed" or "value added" products available in the full-service and self-service departments is increasing almost daily. Consumers are looking for healthy alternatives in convenience foods. Seafoods that are prepared and "ready to cook" offer consumers fresh products with minimal preparation.
- ▶ Packaging innovations offer many conveniences to retailers as well as to consumers. Retailers are no longer limited to over-wrap. Shrink wrap packages and plastic containers are also available which provide the customer with a "neat" package for transport. Packaging is also more attractive and convenience oriented. Heat & serve, boil-in-bags and microwaveable packages are a few of the new innovations.

³1987. Retail Seafood Study. Food Marketing Institute and the Gulf & South Atlantic Fisheries Development Foundation, Inc.

THE CUSTOMER PURCHASE DECISION PROCESS: EDIBILITY SIMILARITIES IN SEAFOODS AND VALUE

All consumers evaluate their options before actually making a purchase. The evaluation procedure for foodstuffs involves answering several questions:

- (1) What is this item?
- (2) Do I know the best way to prepare it?
- (3) Will my family enjoy it?
- (4) Is it within my budget constraint?
- (5) If I do not purchase this item what are my alternatives?

These questions center on two issues: acceptability and affordability. For a product to be acceptable, consumers must know how to incorporate it into a recipe and they must have a positive feeling of how family and/or friends will react to the finished product. Affordability is another objective that is required for consumers to make a purchase. Quite often, these two objectives are mutually exclusive. That is, acceptable products may be too "pricey", or affordable products may not be "familiar" to shoppers. Retail success with seafoods requires resolving these two issues for consumers.

Seafoods are the only meat item that must be identified by species name. Unfortunately, species name says nothing about how a product will taste, and provides no basis for comparing similar-tasting but differently priced varieties. Consider other meats. Species never enters the retail identification system because it is irrelevant in describing flavor, texture, and color; or the preferred cooking technique. The same is true with fishes, but species must still be used as the identifier according to Federal regulations.

What concepts can retailers employ to assist customers? Similar market forms should be compared. Second, there is generally more difference among the names and costs of most seafoods than there is in the taste. Also understand that edibility differences are generally differences of degree, not absence or presence of a particular trait.

Using generic recipes which only specify market form, displaying similar market forms, and perhaps sampling of similar-tasting but differently priced products are good ways to communicate similarity.

There is a higher gross margin available from the sale of less familiar species due to differences in their costs. Therefore, a seafood operation which incorporates these species will generate a higher overall gross than those which strictly focus on the "tried-and-proven" but more expensive items. For a detailed discussion of this topic, see Appendix I.

SUBSTITUTING FINFISH

With shellfish, the zoological families are likely to be the same. A blue crab is not exactly like a snow crab, but they both have similar taste, texture and cooking characteristics. Finfish, however, are a totally different matter. To take advantage of seasonal availability of the different species of finfish, refer to the SUBSTITUTION GUIDE. This guide lists species according to their eating characteristics such as flakiness, color of meat, moistness, flavor and fat content. Therefore, substitutions can be made within the various groups if a recipe calls for a species which is out of season or otherwise unavailable. For a detailed discussion of strategies for substituting seafood, see Appendix I.

Species Substitution Chart *

White meat, Very light, delicate flavor

Cod	Pacific Sanddab	Spotted Cabrilla
Cusk	Pacific Sole	Witch Flounder
Dover Sole	Rex Sole	Yellowtail
Haddock	Southern Flounder	Flounder
Lake Whitefish	Summer Flounder	Yellowtail Snapper
Pacific Halibut		

White meat, Light to moderate flavor

American Plaice/Dab	Mahi Mahi	Starry Flounder
Arrowtooth Flounder	Pacific Whiting	White King
Butterfish	Red Snapper	Salmon
Catfish	Rock Sole	Whiting
Cobia	Sauger	Winter Flounder
English Sole	Snook	Wolffish
Lingcod	Spotted Seatrout	

Light meat, Very light, delicate flavor

Alaska Pollock	Rainbow Trout
Black Sea Bass	Smelt
Brook Trout	Tautog
Giant Sea Bass	Walleye
Grouper	White Crappie
Pacific Ocean Perch	

Light meat, Light to moderate flavor

Atlantic Ocean Perch	Chinook Salmon	Sablefish
Atlantic Salmon	Lake Chub	Sand Shark
Black Drum	Lake Herring	Sculpin
Buffalofish	Lake Sturgeon	Scup/Porgie
Burbot	Lake Trout	Sheepshead
Carp	Monkfish	Silver (Coho)
Chum Salmon	Mullet	Salmon
Crevalle Jack	Northern Pike	Spot
Croaker	Perch	Striped Bass
Eel	Pink Salmon	Swordfish
Gray Seatrout	Pollock	Vermillion
Greenland Turbot	Pompano	Snapper
Jewfish	Rockfish	

Light meat, More pronounced flavor

Atlantic Mackerel
King Mackerel
Spanish Mackerel

Darker meat, Light to moderate flavor

Bluefish	Sockeye (Red) Salmon
Ocean Pout	

* Virginia Species are highlighted in bold type.

SEASONAL AVAILABILITY

Most seafood selections change on a seasonal basis. "Seasonal availability" or "seasonal abundance" is related to the migration of fish north to south and east to west in response to seasonal weather conditions, especially water temperatures. Seasonality frequently influences price; therefore, it is wise to take advantage of what is in season.

The following table lists many of Virginia's food fish and shellfish. The peak months for harvesting these mid-Atlantic species is also given. However, many of these species may be available year round due to improved refrigeration and transportation.

MID-ATLANTIC SPECIES

PEAK MONTHS

Crab, Blue: (hard)	Year Around
Scallop, Sea	Year Around
Clam, Surf	Year Around
Fluke (Summer Flounder)	Year Around
Spot	March - December
Croaker	March - November
Oysters, Eastern	Year Around (peak October - June)
SeatROUT, Gray	June - December
Sea Bass, Black	September - April
Bluefish	March - June & October - December
Catfish	Year Around
Mackerel, Atlantic	February - April
Clam, Hard	Year Around
Crab, Blue: (soft)	May - September
Scup (Porgy)	January - April
Monkfish (Anglerfish)	Year Around
Shad, American	March & April
Whiting	January - April
Squid	Year Around
Eel	April - June & September - October
Shark	Year Around
Bass, Striped	Variable
Perch, White	November - March
Drum, Black	May & June

SEAFOOD COOKERY

Ten Minute Rule

Timing is the real secret of delicious fish cookery. Fish is cooked when the meat turns opaque and separates slightly when tested with a fork. Overcooked fish is dry and lacks flavor.

The ten-minute rule is a simple and practical method of timing for fish cookery. Measure the dressed fish, fillet or steak at its thickest part. Allow 10 minutes of cooking time per inch of thickness. For fish that are less than one inch thick, shorten the cooking time proportionally. Double the cooking time for fish still frozen, for example, allow 20 minutes per inch of thickness. If fish is cooked in foil or in sauce, allow an extra 5 minutes per inch. Test for doneness during preparation to avoid overcooking.

The following cooking methods should be timed according to the **Ten-Minute Rule**:

Bake: Place dressed fish, fillets (skin side down) or steaks in a greased baking dish. Brush with margarine, oil or sauce to keep it moist. Bake at moderate temperature (350°F) until fish is done.

Broil: Select fillets, steaks or dressed fish and arrange in a single layer on a well-greased broiler rack. Keep fish that is thinner than one inch, about 4 inches from the heat source, thicker pieces should be broiled about 6 inches from the heat source to prevent uneven cooking. Baste with melted margarine or oil before, during and after broiling. Do not turn. Seafood that can be broiled is generally suitable for the grill.

Grill: Fillets, steaks or dressed fish as well as shellfish can be grilled. Fish for the grill can be marinated to enhance flavor. Bottled Italian dressing or any other marinade can be used for a simple recipe. Seafood only needs to marinate for 20-30 minutes. Prepare a bed of charcoal briquettes in grill pan. Coat the grate with vegetable oil. A thin coat of oil can also be applied to the fish to prevent sticking. Place fish fillets skin-side down on the grate, cover grill. Fish pieces thicker than one inch should be turned over half way through the cooking time. Refer to the broiling section for the distance away from the heat source to place the thicker pieces of seafood.

Oven Fry: Bread fish as in pan frying. Place in a well greased shallow baking dish. Pour a little melted margarine over the fish. Bake in a pre-heated 500°F oven. Do not turn or baste. Oven frying is a convenient way to enjoy fried flavor.

Pan Fry: Dip clean and dressed small fish or fillets into milk or beaten egg and then into bread crumbs, cornmeal or flour. Heat $\frac{1}{4}$ to $\frac{1}{2}$ inch oil in a pan. Place the coated fish in hot oil, in a single layer. Turn over midway through cooking. Most fish may also be pan-fried without breading.

Poach: Place enough liquid to barely cover a single layer of fish in a shallow, wide pan such as a large sauce pan. Milk, plain or seasoned water, or wine are several of the liquids that can be used. Bring liquid to a boil. Add fish; then reduce heat to keep liquid at a simmering temperature. The poaching liquid should not boil while the seafood is being cooked. The boiling action of the liquid causes the flesh to break apart. Very delicate fillets such as flounder can be wrapped in cheese cloth to prevent them from breaking apart during cooking.

Steam: Use a steam cooker or a deep pot with a tight cover. The pot should be deep enough to hold a wire basket or rack to keep the fish above the liquid. Pour about 2 inches of water into the pot and bring to a rapid boil. Place fish on a rack or in a basket. Cover pot tightly and steam.

HOW TO EAT A PAN-DRESSED FISH

Eating a pan-dressed fish can be just as enjoyable as eating a fillet, if you know where to look for the bones. Many round fish (as opposed to flatfish such as flounder) are too small to be filleted efficiently; therefore, they are pan dressed. Some examples of these fish include croaker, small gray seatrout (or "pan trout"), small bluefish (or "tailor blues"), black sea bass and spot. The number and seemingly random location of the bones often discourage a potential eater because they just seem to be more trouble than they are worth. The description of how to eat a pan-dressed fish, along with Figure 1 may help to make eating a "bony" fish more enjoyable.

A typical roundfish is shaped like an oval tube, with the backbone through the center between two thick strips of flesh. A line of bones extends upward from the spine, toward the dorsal fin. Along the bottom of the spine, a double line of bones fans out vertically to enclose the entrails. Remember, where there are fins there are bones in the flesh to support the fins.

Place the cooked pan-dressed fish on a plate so that the belly flap is toward you. Remove skin from the top side of the fish (unless you prefer to eat it).

The meat above the lateral line, between the backbone and the dorsal fin, will flake easily with a fork. This is called the loin section. Remove this portion in pieces without shredding it by lifting the meat head end to tail onto the plate.

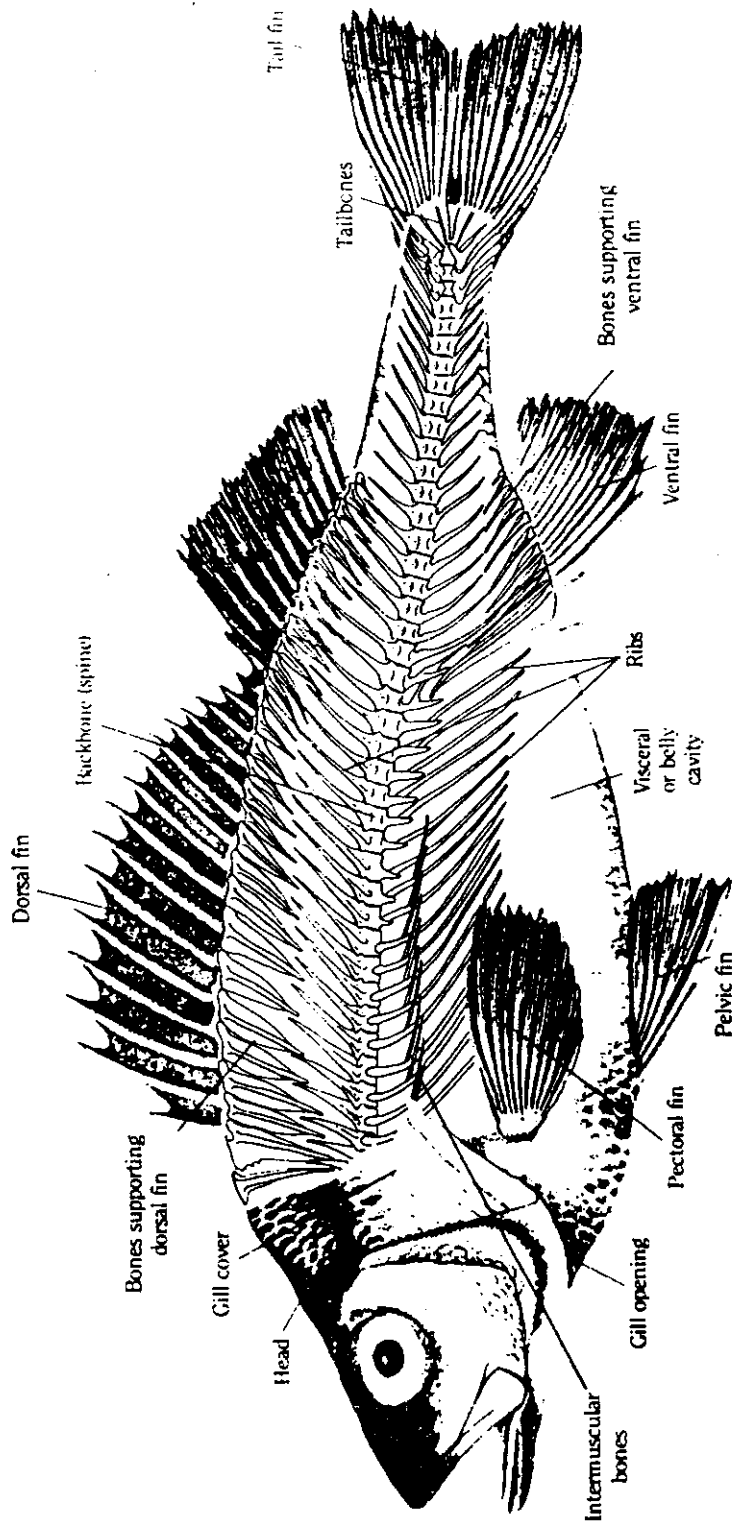


Figure 1: Bone structure of a typical round fish.

The belly flap is the tricky part. There are rib bones and intermuscular bones that you have to look for. The rib bones line the belly cavity. The intermuscular bones are in the meat. Lift the meat up with a fork and turn it over onto the plate. The rib bones should be visible but remain on the skeleton. The intermuscular bones may be sticking up out of the meat or sticking up from the skeleton. Between the ventral fin (small fin near tail) and the tail, small bones will not be a problem because they remain attached to the backbone.

When all the meat is removed from the top portion, carefully lift the dorsal and ventral fins and attached bones. The back bone can then be lifted out along with the tail bones and tail fin. Then remove any of the intermuscular bones or ribs that may remain in the belly flap and enjoy the other half of the fish!

NUTRITION

The availability of more than 250 individual species of seafood make it easy to plan meals that are varied, eye-appealing, delicious and best of all, nutritious.

Seafoods provide an excellent source of high quality protein. A 4-ounce serving will supply about half the total amount of protein that adults require each day. In addition, seafood protein is easily digested.

Seafoods are also good sources of vitamins A, B and D providing (depending on species), phosphorus, potassium, iron, fluorine and iodine. Although many fish species come from salt water, the salt content of fish is relatively low and fish can be used in low-sodium diets. Molluscan shellfish are generally higher in sodium.

Seafoods are low in fats, and those that are present are mostly polyunsaturated. Because seafoods are low in fats, they are also generally low in calories. Seafoods can help reduce caloric intake, and still provide adequate protein to meet the body's requirements. They are a natural for dieters and anyone concerned with maintaining a desired weight.

Fish Oils: Omega 3

Research on omega 3 fatty acids has indicated that seafood may be the up and coming health food! Omega 3 fatty acids are the building blocks that make fish oils so special. These oils are found almost exclusively in marine life, coming from phytoplankton in the fish's diet. They are highly polyunsaturated oils. Vegetable oils are also polyunsaturated but not to the same degree as fish oils. Vegetable oils usually contain a predominance of omega 6 fatty acids.

The two most common omega 3's in fish oils are called eicosapentaenoic acid and docosahexanoic acid, abbreviated, EPA and DHA. Omega 3 fatty acids can be found in several tissues in humans, such as nerve cells, retina, brain and spermatozoa.

Interest in omega 3's began in the 1970s with research on the Greenland Eskimo diet. Researchers noted that the Greenland Eskimos had a lower incidence of heart disease compared to Danes and Americans. Fewer cases of heart disease were associated, in part, with lower levels of cholesterol and fats in the blood. These findings were related to the high content of EPA and DHA in the Eskimos' diet which consists largely of marine animals and fish. The interesting thing about the Eskimo diet is that it is also high in total fat, protein and cholesterol.

Some studies show decreases in blood triglycerides, cholesterol and VLDL- and LDL-cholesterol when omega 3's are present. In addition, a few studies show increases in HDL-cholesterol. VLDL's and LDL's are compounds found in the body that are made up of fat and protein; they are used to transport triglycerides and cholesterol, respectively, through the blood. HDLs transport cholesterol to the liver to be broken down. High levels of HDLs have been associated with lower risk of heart disease, whereas high levels of VLDLs and LDLs are associated with increased risk of heart disease.

The table below lists the omega 3 content for a few of the more common fish species. Most shellfish have 0.4 grams or less omega 3.

Nutrition Composition ⁴
per 100 grams, edible portion*

Species	Protein g	Fat g	Omega 3 g	Chole- sterol mg	Calories
Finfish					
Bass, Striped	17.7	2.3	0.75	80	97
Bluefish	20.0	4.2	0.77	59	124
Butterfish	17.3	8.0	-	65	146
Carp	17.8	5.6	0.35	66	127
Catfish	18.2	4.3	0.37	58	116
Catfish, Ocean	17.5	2.4	0.62	46	96
Cisco, smoked	19.0	3.3	1.25	32	177
Cod, Atlantic	17.8	0.7	0.18	43	82
Cod, salted	62.8	2.4	0.43	152	290
Croaker	17.8	3.2	0.22	61	104
Dolphin (mahi mahi)	18.5	0.7	0.11	73	85
Eel	18.4	11.7	0.15	126	184
Flatfish	18.8	1.2	0.20	48	91
Grouper	19.4	1.0	0.25	37	92
Haddock	18.9	0.7	0.18	57	87
Halibut	20.8	2.3	0.36	32	110
Herring, pickled	14.2	18.0	1.39	13	262
Mackerel, Atlantic	18.6	13.9	2.30	70	205
Mackerel, King	20.3	2.0	0.31	53	105
Mackerel, Spanish	19.3	6.3	1.65	76	139
Monkfish	15.5	1.5	-	25	76
Mullet	19.4	3.8	0.32	49	117
Perch, Ocean	18.6	1.6	0.29	42	94
Perch, White and Yellow	19.4	0.9	0.25	90	91
Pike	19.3	0.7	0.11	39	88
Pike, Walleye	19.1	1.2	0.31	86	93
Pollock	19.4	1.0	0.42	71	92
Roughy, Orange	14.7	7.0	0.01	20	126
Salmon, Atlantic	19.8	6.3	1.44	55	142
Salmon, Chinook, smoked	18.31	4.3	0.45	23	117
Salmon, Coho	21.6	6.0	0.81	39	146
Scup (Porgy)	18.9	2.7	-	-	105
Sea Bass, Black	18.4	2.0	0.60	41	97
Seatrout	16.7	3.6	0.37	83	104
Shad	16.9	13.8	-	-	197
Shark	21.0	4.5	0.84	51	130
Smelt, Lake	17.6	2.4	0.69	70	97

⁴1987. Composition of Foods: Finfish and Shellfish Products; Raw, Processed, Prepared. USDA Human Nutrition Information Service. Agriculture Handbook No. 8-15.

Species	Protein g	Fat g	Omega 3 g	Chole- sterol mg	Calories
Snapper	20.5	1.3	0.31	37	100
Spot	18.5	4.9	0.63	-	123
Sturgeon	16.1	4.0	0.29	-	105
Surimi	15.2	0.9	-	30	99
Swordfish	19.8	4.0	0.64	39	121
Tilefish	17.5	2.3	0.43	-	96
Trout, Rainbow	20.6	3.4	0.57	57	118
Tuna, bluefin	23.3	4.9	1.17	38	144
Tuna, yellowfin	23.4	1.0	0.22	45	108
Turbot	16.0	3.0	-	-	95
Whitefish	19.1	5.9	1.26	60	134
Whiting	18.3	1.3	0.22	67	90
Shellfish					
Crab, Blue	18.1	1.1	0.32	78	87
Crab, King	12.0	0.6	-	42	84
Crab, Dungeness	17.4	1.0	0.31	59	86
Crayfish	18.7	1.1	0.17	139	89
Lobster	18.8	1.0	-	95	90
Shrimp	20.3	1.7	0.48	152	106
Lobster Tails	20.6	1.5	0.37	70	112
Clam	12.8	1.0	0.14	34	74
Mussel	11.9	2.2	0.44	28	86
Oyster, Eastern	7.1	2.5	0.44	55	69
Oyster, Pacific	9.4	2.3	0.69	-	81
Scallop	16.8	0.8	0.20	33	88
Squid	15.6	1.4	0.49	233	92

* 100 grams equals approximately 3 1/2 ounces. All values are for raw products.

MANAGEMENT OF THE SEAFOOD DEPARTMENT

A retail seafood department is a major investment. There are space (backroom and sales area) costs; there are equipment costs; there are inventory and supply costs; there are labor costs (skills development as well as actual work time). Getting the greatest returns from this investment takes well laid departmental management plans and then good execution of those plans. If the department is to be successful, top management must have full understanding of these investment costs and the need for good management of the labor, inventory and facility resources to assume an adequate return. In other words, top management must definitely commit itself to insuring the seafood department that it has adequate backing in resources and management assistance.

PLANNING MANAGEMENT

Planning for successful (profitable) seafood department management may be done in several ways. Here, it is divided into several segments. They are: Goal Setting; Defining Areas of Management Responsibility; Defining Levels of Management Authority; and Combining Areas of Management Responsibilities and Authority into a Seafood Department Management Program.

Goal Setting

Satchel Paige, the great baseball pitcher, reportedly once said, "If you don't know where you're going, you may end up somewhere else." He was right! Unless there are definite department goals (Total Sales, gross margin, shrink, contribution to overhead, labor productivity, etc) it's net effect on total store operations will be "somewhere else" - a surprise.

Top management sets the overall goals for the firm; the store's goals must fall within the framework established for the firm; and the department goals then become a part of the store's. A simple illustration of this is:

Firm goal = seafood = 2% of firm sales

Store goal = seafood = 1.75% of store sales

Dept. goal = seafood = \$4500/week

Other goals would be set in the same way.

AREAS OF MANAGEMENT RESPONSIBILITY

Once the firm, store, and department goals are set, you can examine the areas of management responsibility most important to operating the seafood department. In interviews with seafood marketing personnel in various retail grocery firms, these responsibilities were emphasized. Goal setting, operational controls on handling, margin and inventory control, employee productivity and employee training and education.

Goal Setting

Discussed above.

Operational Controls on Handling

1) Receiving -- Making sure the correct amounts of the correct product of the correct quality and billed at the correct price is received.

2) Storage -- Maintaining quality through proper storage.

3) Processing -- Handling the product so as to maintain quality, meet sanitation requirements, and minimize shrink.

4) Packaging -- Whether prepackaged or service department, packaging should be attractive and sanitary, as well as help maintain quality.

5) Display -- Arranging and placing the products for greatest customer sales.

Management Authorities: Again, interviews with grocery firms revealed that basically, there are three levels of direct management for seafood retailing in most grocery firms. They are the seafood merchandiser, the store manager, and the department manager. Each level has some involvement with all the management responsibilities listed above, but the degree of involvement varies. A table or matrix, based on interview results, of the extent of these involvements in each management responsibility is:

**Seafood Department Manager Matrix
Management Level ***

	Merchandiser	Store Mgr.	Dept. Mgr.	Employee
AREAS OF MANAGEMENT RESPONSIBILITY				
Goal Setting	H	M	H	L
Operational Control				
Receiving	L	L	H	M
Storage	L	M	H	M
Processing	M	L	H	H
Packaging	M	L	H	H
Display (Quality Control)	M	M	H	H
Margin and Inventory Control				
Inv. Mgt. (ordering, shrink. control)	M	L	H	L
Pricing	H	L	L	L
Advertising & Promotion	H	L	L	L
Display Merchandise	M	L	H	H
Employee Productivity	M	M	H	M-H
Mix	H	L	H	L
Record Keeping & Reports	M	M	H	M
Employee Training & Education	H	L-M	H	M

*L = Low, M = Medium, H = High levels of responsibility

The exact matrix of responsibilities and the level of involvement will vary somewhat from firm to firm. However, management within each individual firm may change the chart or matrix to fit its own management system.

Margin and Inventory Control

- 1) Inventory Control -- Ordering the correct amounts and minimizing product shrink.
- 2) Pricing -- Establishing product prices that will produce the desired sales volume and gross margin.
- 3) Advertising and Promotion -- Devising an advertising and program strategy to assist in achieving sales and profit goals.
- 4) Display -- Creating attractive, "selling" displays to help reach sales goals.
- 5) Product Mix -- Determining the number and types of product to carry.
- 6) Employee Productivity -- Making sure that employees pay their way with sufficient sales and that the customers have enough service to keep them happy.
- 7) Record Keeping and Reports -- Maintaining the records and preparing the reports which permit departmental management evaluation.
- 8) Employee Training and Education -- Insuring that employees have the technical knowledge and skills needed to maintain productivity.

Implementing the Plan

Once the matrix of management responsibilities and management involvement is developed, a management framework becomes apparent. The matrix makes it easy to:

- 1) Develop job descriptions or profiles for the different levels of management that accurately describe what is expected of each.
- 2) Define the responsibilities that various personnel have in managing the seafood department. In reality, these are performance goals for the manager.
- 3) Ascertain the resources and the authority the manager needs

in order to effectively meet the assigned responsibilities.

- 4) Evaluate how well the manager performs, both in specific aspects of management and in total performance.

A way in which this plan and matrix may be incorporated into a seafood department management supervision and evaluation program is illustrated in Appendix II.

PRODUCT MARGIN MANAGEMENT

The desired result from a retail seafood marketing program is to make a profit. The purpose of this analysis is to show the impact of retail prices, procurement prices, and shrinkage values on the margin management practices of a department.

The thrust of this analysis focuses on the revenue aspects of the seafood department. The differences between revenues and costs shall be designated as gross margin dollars. These gross margin dollars provide funds to cover the costs of operating the department and to make a contribution to retail store overhead. This publication utilizes prices and margins only in an educational context, and does not represent or endorse prices to be charged to customers, or prices to be paid to supply sources. However, the prices and values expressed in this analysis have been collected from research surveys and data sources, and are believed to be representative of the industry.

The seafood products utilized in this analysis highlight the seasonal nature of the seafood industry offerings and show the contrast between a typical summer and winter product mix (See Table 1 and 2 for species selection). Some seafood products are available only in summer, or in winter, and some on an annual basis.

Generating revenues from a seafood department is an essential step in the profitable management and operation of a seafood department. This management problem involves meeting consumer needs by the proper product selection, pricing, merchandising, and quality assurance efforts.

A successful margin management program means implementing a strong consumer service program, a well defined management program, and controlling the variables of pricing, shelf life (quality assurance), and merchandising and product line management.

An effective margin management program means understanding the relationships of supply and demand variables and being able to analyze the results as applied to a seafood department

Va Tech, Ag Econ

Table 1. Margin Analysis for Seafood Department (*):

A Typical Summer Product Mix (Alternative 1)

Seafood SPECIES	Unit Measure	Units Bought	Unit Cost	Cost of goods	Shrink -age	Retail Price	Units Sold	Value of Good sold	GM w/sh \$	GM wo/sh \$	GM no/sh %	GM w/sh %
Finfish												
Bluefish (Whole)	lb	200	.30	60.00	.06	.94	188	176.72	116.72	128.00	68.085%	66.048%
Bluefish (Filet)	lb	200	1.00	200.00	.09	1.59	182	289.38	89.38	118.00	37.107%	30.887%
Butterfish	lb	200	.90	180.00	.05	1.24	190	235.60	55.60	68.00	27.419%	23.599%
Croaker (H&G)	lb	220	1.44	316.80	.06	1.94	206.8	401.19	84.39	71.20	25.773%	21.035%
Croaker (Whole)	lb	80	.58	46.40	.05	1.24	76	94.24	47.84	52.80	53.226%	50.764%
Seatrout Pan	lb	210	.63	132.30	.07	1.39	195.3	271.47	139.17	145.70	54.676%	51.265%
Med	lb	250	.85	212.50	.06	1.59	235	373.65	161.15	105.50	46.541%	43.129%
Mackeral	lb	100	.75	75.00	.05	1.49	95	141.55	66.55	74.00	49.664%	47.015%
Spot (whole)	lb	50	.60	30.00	.05	2.19	47.5	104.03	74.03	79.50	72.603%	71.161%
Shellfish												
Clams (live)	each	200	.14	28.00	.10	.28	180	50.40	22.40	28.00	50.000%	44.444%
Crabmeat (Fresh)												
Backfin	lb	25	9.88	247.00	.02	11.88	24.5	290.94	43.94	49.88	16.800%	15.102%
Cocktail Claws	lb	10	4.90	49.00	.00	7.49	10	74.90	25.90	25.90	34.579%	34.579%
Special	lb	35	5.10	178.50	.02	7.23	34.3	247.82	69.32	74.38	29.412%	27.971%
Softshell												
Jumbo	doz	25	12.95	323.75	.00	15.45	25	386.25	62.50	62.50	16.181%	16.181%
Primes	doz	20	10.45	209.00	.00	12.45	20	249.00	40.00	40.00	16.064%	16.064%
Scallops	lb	25	4.85	121.25	.05	7.49	23.75	177.89	56.64	66.00	35.247%	31.839%
Shrimp												
70/80	lb	150	2.35	352.50	.06	3.75	141	528.75	176.25	210.00	37.333%	33.333%
40/50	lb	100	4.80	480.00	.06	5.87	94	551.78	71.78	107.00	18.228%	13.009%
26/30	lb	50	6.43	321.50	.06	8.23	47	386.58	65.08	89.75	21.824%	16.834%
Value added												
Herring smoked	lb	15	2.12	31.80	.03	7.90	14.55	114.95	83.15	86.70	73.165%	72.335%
Seafood Salad	lb	30	3.04	91.20	.03	4.89	29.1	142.30	51.10	55.50	37.832%	35.910%
TOTALS				3686.50				5289.37	1602.87	1738.30	32.044%	30.304%

(*) Developed by G. Spittle and C. W. Coale, Jr.

Va Tech, Ag Econ

Table 2. Margin Analysis for Seafood Department (*):

A Typical Winter Product Mix (Alternative 2)

Seafood SPECIES	Unit Measure	Units Bought	Unit Cost	Cost of goods	Shrink -age	Retail Price	Units Sold	Value of Good sold	GM w/sh \$	GM wo/sh \$	GM no/sh %	GM w/sh %
Finfish												
Blue (Whole)	lb	200	.51	102.00	.06	1.14	188	214.32	112.32	126.00	55.263%	52.408%
Blue (Filet)	lb	250	1.14	285.00	.07	1.88	232.5	437.1	152.1	185.00	39.362%	34.798%
Flounder												
Large	lb	120	2.63	315.60	.05	3.59	114	409.26	93.66	115.20	26.741%	22.885%
Medium	lb	100	2.38	238.00	.06	3.43	94	322.42	84.42	105.00	30.612%	26.183%
Mackerel (Atlantic)	lb	250	.72	180.00	.09	1.88	227.5	427.7	247.7	290.00	61.702%	57.914%
Monk	lb	40	2.20	88.00	.04	3.38	38.4	129.792	41.792	47.20	34.911%	32.199%
Perch (Ocean)	lb	50	2.23	111.50	.05	3.29	47.5	156.275	44.775	53.00	32.219%	28.651%
Black Sea Bass	lb	40	2.44	97.60	.05	3.29	38	125.02	27.42	34.00	25.836%	21.932%
Whiting	lb	100	.75	75.00	.07	1.51	93	140.43	65.43	76.00	50.331%	46.593%
Shellfish												
Oysters												
Select	pts	16	3.92	62.72	.02	4.79	15.68	75.1072	12.3872	13.92	18.163%	16.493%
Standard	pts	32	3.82	122.24	.02	4.69	31.36	147.0784	24.8384	27.84	18.550%	16.888%
Shell	bushels	1	20.50	20.50	.10	23.50	.9	21.15	.65	3.00	12.766%	3.073%
Scallops (Sea)	lb	40	5.45	218.00	.02	7.99	39.2	313.208	95.208	101.60	31.790%	30.398%
Shrimp												
70/80	lb	100	3.50	350.00	.06	4.59	94	431.46	81.46	109.00	23.747%	18.880%
40/50	lb	150	4.58	687.00	.06	5.64	141	795.24	108.24	159.00	18.794%	13.611%
26/30	lb	70	5.80	406.00	.06	7.84	65.8	515.872	109.872	142.80	26.020%	21.298%
TOTALS				3359.16				4661.433	1302.273	1588.56	.3210691	.2793718

(*): Developed by G. Spittle and C. W. Coale, Jr.

program. One method of assessing the revenues generated is the application of an electronic spreadsheet to calculate the results of product prices charged and volumes of product sold in a daily marketing effort of the department.

The electronic spreadsheet analysis, applied in this publication, enables a manager to ask "what if" questions about the seafood department sales program. The questions relate to the results being accomplished from merchandising program for a given product mix. A spreadsheet analysis for a seafood department can be calculated on the basis of a day, a week, or a year of economic activity. The spreadsheet model illustrated here closely approximates a typical store on a weekly basis. A series of "what if" questions can be asked electronically and the results used to demonstrate the impacts of changes in retail prices, cost of goods, and the net weight of marketable products (See appendix II for definitions of the spreadsheet model).

The composition of two seasonal departmental scenarios show how fish species are listed in an electronic spreadsheet (See Table 1 and 2). The scenarios shown (in Table 1 and 2) illustrate two seasonal periods (summer and winter). The species are defined by common name and classified by finfish, shellfish, and value-added products. The department manager can specify a seasonal product mix and enter the expected volume to be sold during a period (example shows potential volume for a week). The manager enters corresponding retail prices, cost of goods, and loss in net weight (shrinkage) into the spreadsheet model. The electronic spreadsheet is calculated showing the new results from the entries.

What information can the results of spreadsheet modeling show the seafood department manager? In an initial calculation, the results show units sold (H:11-40), revenue of seafood products sold (I:11-40), gross margin dollars with net weight loss (J:11-40), and gross margin percentage with net weight loss (M:11-40).

During the initial calculation of the electronic spreadsheet, the manager has determined the value of the revenues for each species in the product mix and what each species (by line item) contributes to the department in terms of value, gross margin dollars, and percentages. The gross margins percentages show whether the products are producing an adequate percentage when compared to other items in the product mix and whether the value compares to the industry standards for a given line item. The gross margin dollars (by species) show the retailer the impact of retail pricing, cost of goods, and net weight loss on the dollars being generated in the department. These dollars are directly applied to cover the costs of operating the department, and to make a contribution to the overhead costs of the department.

Management of the department impacts heavily on the gross margins dollars available after a sales period. The careful evaluation of the prices, cost of product, and the shrinkage shows the manager about the performance of the species marketed. Whole bluefish (row 12) shows that 200 pounds sold during the sales period generates a gross margin of 66 % and gross margin dollars of \$116 (See Table 1). If the department manager is striving for a 30 % gross margin percentage for the department, the bluefish product is a positive contributor to the product mix. On the other hand, if 100 pounds of 40/50 count shrimp are marketed, given the prices and costs noted in the spreadsheet a 13 % gross margin will be realized and \$71 contributed to departmental revenues. A department manager has an understanding of the contribution of each product in the mix and additional "what if" questions can be asked about the specific merchandising, promotional, and quality handling of these products that will contribute higher gross margins (percentages and dollars) to the department revenues.

A department manager may apply new values (retail prices, cost of goods, and net weight losses) to the electronic spreadsheet, recalculate the spreadsheet, and reassess the economic impact of a specific species on the departmental program. By recalculating the electronic spreadsheet after changing base line values, the manager can develop a keen sense of what happens to margins with certain changes in base values. This sensitivity by management about the impacts on gross margins by even a slight change in value of a base rate should provide greater insights about the need for controlling the fundamental functions of quality assurance, merchandising, and management. The electronic spreadsheet discussion has focused attention on an individual species and its contribution to the department, and contribute to an aggregate analysis.

The electronic spreadsheet shows the value of departmental operations derived from a sales period (Table 1, line 43). The values in this value line show the cost of goods (E:43), the total revenue generated (I:43), the gross margin dollars with net weight loss (J:43), and the gross margin percentage for the department (M:43). From the spreadsheet, the department manager has economic information that provides financial and personnel planning for operating the department. The financial information shows how many dollars will be spent for the cost of goods (E:43), how many dollars will be generated in the department (I:43), and how dollars will be generated to operate the department (M:43), and whether the gross margin percentage goal for the department has a potential for being met. If a retail store is realizing \$200,000 per week in total store sales, the spreadsheet for illustrating a typical summer product mix shows that seafood sales equal 2.6 % of total store sales, and generates a 30.3 % gross margin, and \$1,602 dollars to support the departmental operations.

The store management may find these estimated performance standards acceptable for a seafood department. If management finds that any ratios are not acceptable, they have a positive basis for taking corrective action to improve any of the coefficients. The electronic spreadsheet offers management the flexibility to estimate the economic performance of the department into the future. Management has certain performance standards expected from each department. The store and seafood department managers can jointly discuss the performance needed in the department and certain goals can be set. The preceding evaluation of electronic spreadsheet discussions centered around a seasonal product mix (typical summer), however, the availability of product changes from one sales period to another. The exercise may be repeated with an entirely different product mix and the related variables (See Table 2). Again, if a retail store is realizing \$200,000 per week in total store sales, the spreadsheet for illustrating a typical winter product mix shows that seafood sales equal 2.3 % (0.3 % below the 2.6 % of total store sales for a typical summer product mix) and generates about a 28 % gross margin (about 2 % less than the 30.3 % gross margin realized for the estimated summer mix) and gross margin dollars worth about \$1,302 (about \$300 less than the \$1,602 dollars realized estimated summer mix) to support the departmental operations.

Calculating revenues in advance of the season may offer insights for adjusting the product mix to create a more favorable economic situation for departmental operations. The values generated for a potential winter product mix shows that the performance of the department will not meet the summer standard. Closer examination shows where the problems may lie. The margins for the shellfish are generally lower for the winter mix when compared to the summer mix. For example, the 1988 shrimp harvest might be in short supply. By analyzing the potential cost of goods and the corresponding retail prices, the electronic spreadsheet showed that margins for these products might be squeezed, and the supported revenues might not be at a desired level. Management might jointly decide to substitute other products, given edibility characteristics, for the shrimp, or management may decide to stockpile purchased product during favorable market periods. The analysis of the potential revenues by sales period gives management the foresight to make decisions, in advance, to benefit the overall performance of the department.

Another advantage to management for estimating sales targets and setting goals in advance of the sales period is the value of comparing estimated results to actual results. This information about performance during the sales period tends to sharpen the decision making ability of management.

The electronic spreadsheet application gives the seafood

department manager an opportunity to conduct complex analyses by holding all variables in a scenario fixed except one. The spreadsheet is recalculated so that retail prices are changed by the same increment over a range and the corresponding results illustrate the impact of that one variable on a solution. This analysis is illustrated by the incremental change in retail prices (See Table 3). The weighted average for retail prices in the market mix amounts to \$5.11, taking into account the finfish, shellfish, and the value added products. When prices are incremented around the average value of \$5.11, the gross margin percentages change accordingly as explained in the succeeding paragraphs. The variables, cost of raw product and shrinkage, are calculated in a manner similar to that described for the retail price variable and have a corresponding affect on an analysis.

The gross margin percentage changes as the retail price for the product mix changes. The spreadsheet calculation shows what the gains or losses in gross margin percentage for a product mix when the average retail price (set at \$5.11 for the two sales periods S-GMWS, W-GMWS) is incremented over a range of prices (See Table 1, column G, rows 11-40, and Table 3). For example, a typical summer mix with net weight loss (S-GMWS) yields a 30.30 % gross margin whereas the winter mix under the same condition (W-GMWS) yields about a 27.9 % gross margin percent. By moving up and down the gross margin curve for the summer or winter mix, a manager can assess the impact of retail price on expected gross margin percentages.

The value of the market price information, showing the impact of any discounted retail prices on gross margins, gives management an incentive to manage those variables that affect price of products at the retail counter. Retail price discounting can result from the failure to rotate inventoried product (loss of shelf life), over ordering, poor merchandising or poor quality assurance practices. In the worst case, a 25 % retail price decline could cause about a 12 % reduction in gross margin and an advance in retail price could have the opposite effect.

The value of the cost of goods information shows the impact of buying practices on gross margins (See Table 1, column D, rows 11-40 and Table 4). As the prices paid for raw products are reduced, the corresponding gross margins in the seafood department go up and vice versa. Management of a seafood department is faced with a trade-off in buying practices of raw product. The choice appears to be whether a lower priced product will provide an adequate shelf life and meet the value expectations of consumers in the retail market. Conversely, higher raw product prices may only guarantee an available supply during certain periods. The spreadsheet may offer ideas about managing the product lines to secure more favorable gross margins for substitute products.

Table 3

Margin Analysis for Seafood Department (*)

Retail Price vs GM% for Summer and Winter

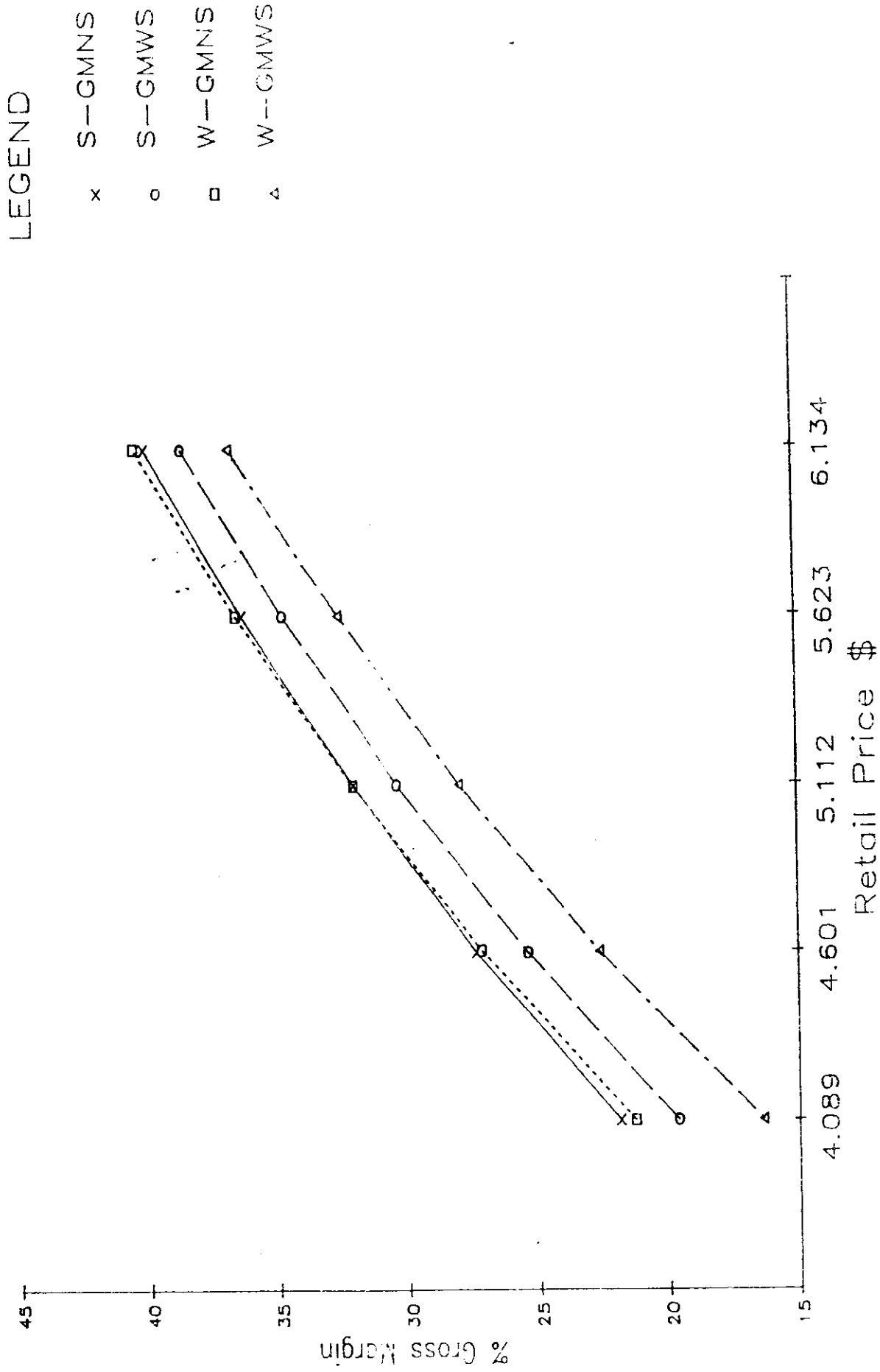
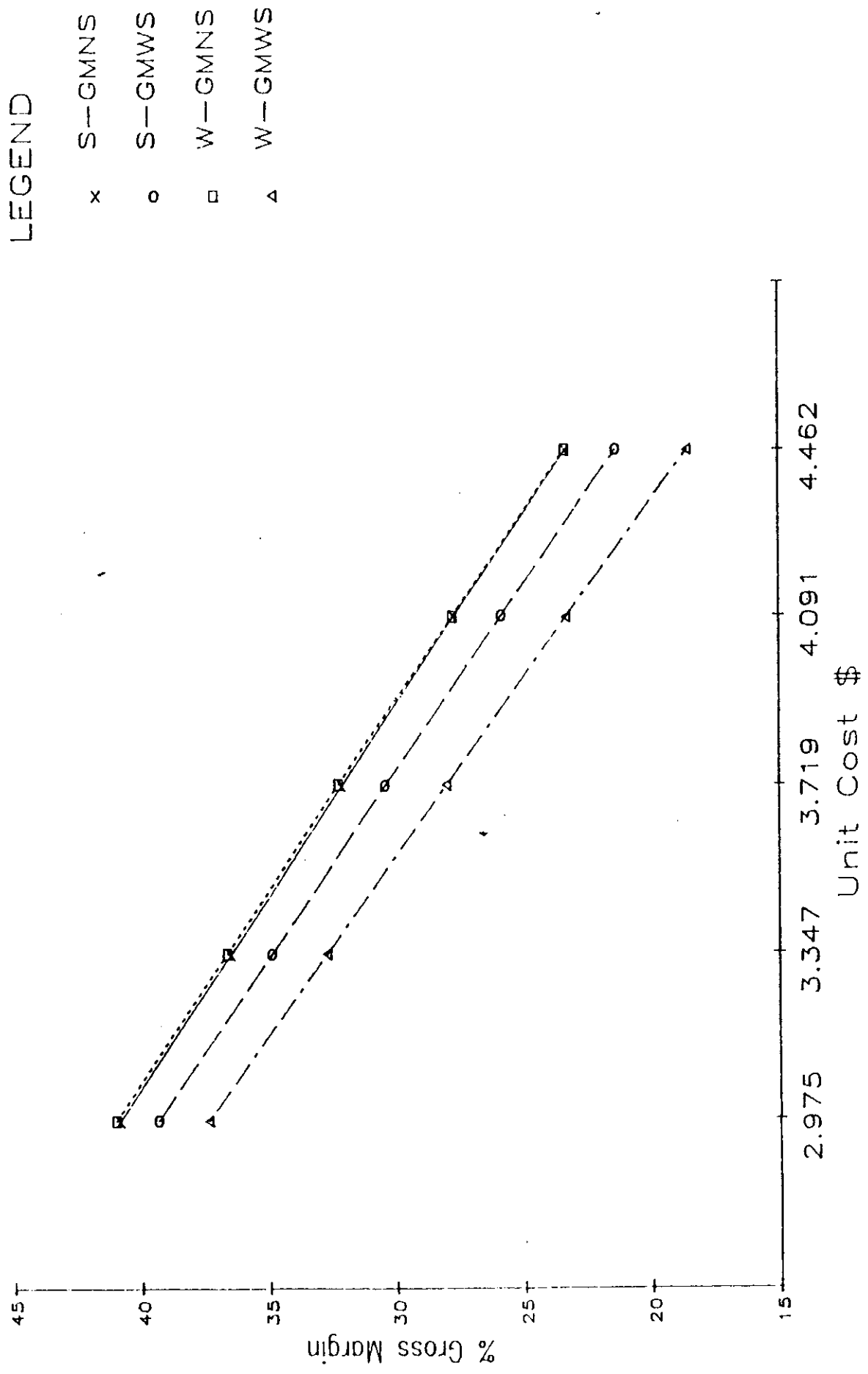


Table 4
 Margin Analysis for Seafood Department (*)
 Unit Cost vs GM% for Summer and Winter

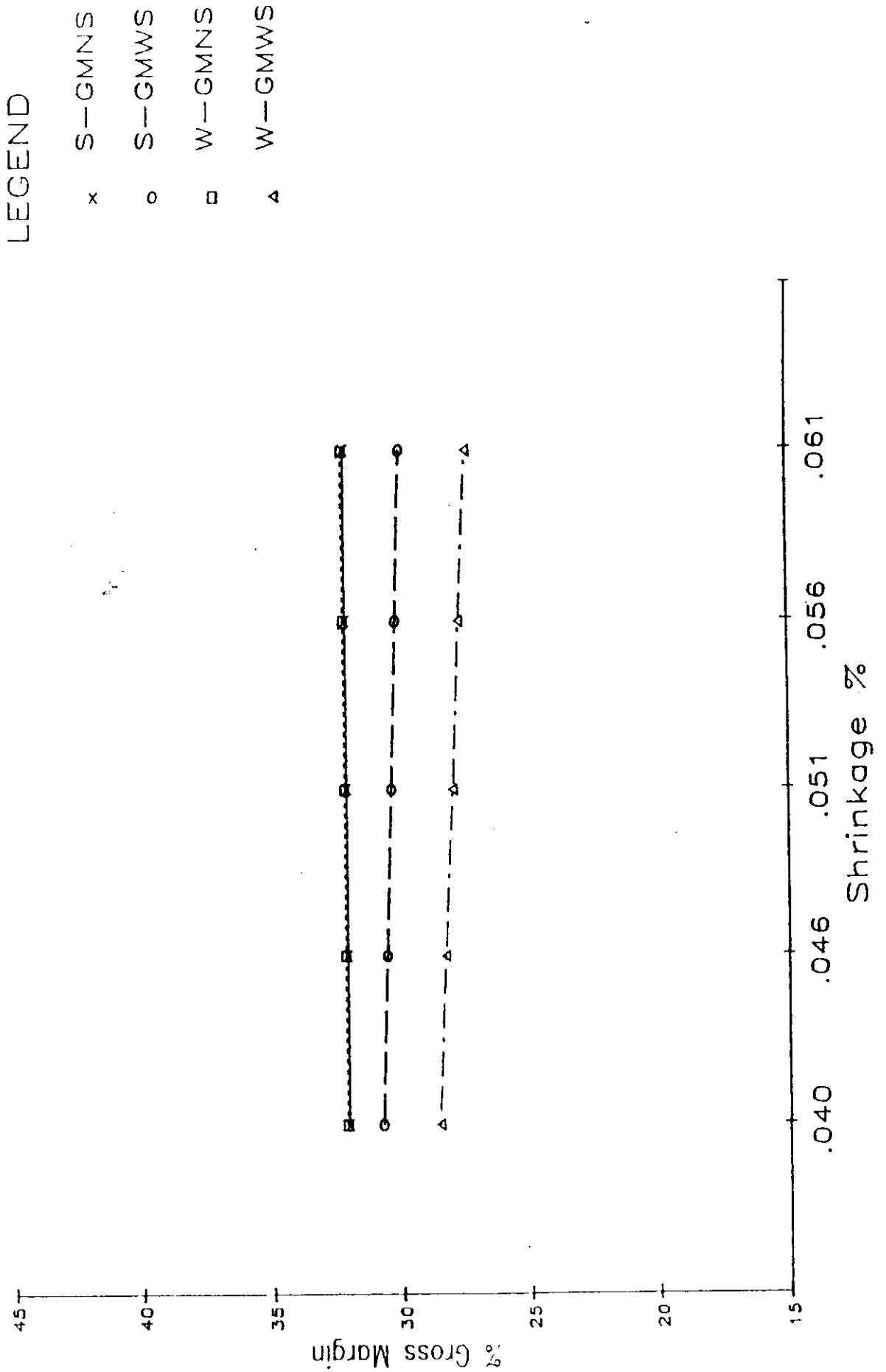


The value of shrinkage information shows the impact of net product weight losses on gross margins. Higher valued products will reduce gross margins more than lower valued products because of their relative worth. In the examples, the higher shrinkage values have been assigned to the finfish products (See Table 5). These shrinkage values have been estimated from quality assurance studies based on the type of product and the type of equipment and holding environment of the products.

The shrinkage analysis shows the results of gross margin percentage changes as the net weight losses for the product mix change. The spreadsheet calculation shows what the gains or losses in gross margin percentage for a product mix when the average shrinkage value (set at about 5 % for the two sales periods S-GMWS, W-GMWS) is incremented over a range of weight losses (See Table 1, column F, rows 11-40, and Table 5).

The control point for product shrinkage is zero, but that value is not obtainable under present conditions. A spreadsheet analysis shows the impact of a range of weight losses on the departmental gross margins. For example, a typical summer mix (S-GMWS) with net weight loss ranging between 4 % and 6 % yields a 30.5 % gross margin whereas the winter mix under the same condition (W-GMWS) yields about a 28.5 % gross margin percent. Again, by moving up and down the gross margin curve for the summer or winter mix, a manager can assess the impact of net weight loss on expected gross margin percentages.

Table 5
 Margin Analysis for Seafood Department (*)
 Shrinkage vs GM% for Summer and Winter



QUALITY MAINTENANCE AND MERCHANDISING

Seafood spoils sooner than many other food products for numerous reasons including chemical make-up, tissue structure and bacterial growth patterns. Some contributors to quality deterioration are nearly unavoidable, but fortunately, most are readily controlled by **keeping the products cold and selling them quickly**. Never underestimate the importance of tight temperature control. A fillet stored at 32° F may keep twice as long as it will at 39° F. A substantial amount of research has documented the mechanisms of deterioration. See appendix IV for an overview of the topic.

To the retailer, the effectiveness of seafood quality control efforts directly impact three factors:

1. Customer satisfaction
2. Safety / liability
3. Product shrink

CUSTOMER SATISFACTION

American consumers buy more seafood now than ever before but surveys indicate that they continue to have concerns when making purchase decisions. Most rely heavily on store reputation and helpful personnel to ease the selection process. Just one experience with old seafood will turn many customers away for good.

Seafood managers who insist on attractive displays, clean departments and strict quality maintenance programs will strengthen customer confidence, not only by ensuring high quality products, but by improving the impression of quality through odor control and appearance.

Think in terms of the customer experience. Professionalism extends from informed personnel and their willingness to help as well as assurance of quality.

SAFETY / LIABILITY

The day-to-day effect of quality maintenance activities is more often noticed in shrinkage and customer loyalty than in food safety, but nothing can be more devastating to sales than a media story relating illness to your seafood.

When they arise, such cases can often be traced back to cross-contamination, where drip from raw seafood is allowed to contact cooked or ready-to-eat products. Proper sanitation and partitioning of products can eliminate the risk. Holding soups or other warm foods below 140° F is another practice sometimes implicated in the spread of disease because pathogenic bacteria can grow freely when "comfortably" warm.

The items listed on the following page respond to common questions or situations encountered in retail departments. For other suggestions for reducing the risk of illness, see "Recommendations for Handling Seafood" and specific product discussions under "Seafood other than 'Fresh' Products".

A List of Food Market Managers' Concerns Regarding Sanitation and Safe Food Handling Procedures

1. Bacteria need specific conditions to grow and multiply.
2. Not all bacteria are harmful.
3. Frozen food should be held at 0°F or below.
4. Bacteria usually need help to go from place to place.
5. Most bacteria do not grow rapidly at refrigerated temperatures.
6. Food products containing food poisoning organisms do not always smell spoiled.
7. Generally safe temperatures for potentially hazardous foods are 45°F or below, and 140°F or above. In rare cases, foods may become hazardous when held as low as 36°F.
8. Seafoods (fresh) should be kept near 32°F.
9. Seafoods are more perishable than other meat items.
10. Food contact surfaces cannot be adequately cleaned without the use of a chemical sanitizer.
11. Even when equipment and utensils (scales, knives, trays, etc.) used to process seafoods are kept clean, it is necessary to sanitize them during a day's processing.
12. Not all sanitizing agents (chlorine, iodophers, and quaternary ammonium compounds) are equally effective for all purposes.

The following situations are identified as to their degree of public health risk.

	<u>High</u>	<u>Medium</u>	<u>Low</u>
1. Sick employees	x		
2. Food stored at 120°F	x		
3. Storing fish, poultry, and meat in the same cooler		x	
4. Smoking and eating by employees in food preparation areas	x		
5. Cracks in floors and walls		x	
6. Meat processing room temperature of 55°F			x
7. Discolored meats			x
8. Product on display past pull date			x
9. Cooked crabs on display next to raw fish	x		
10. Storing raw seafood at 45°F		x	
11. Temperatures above freezing in frozen food case		x	
12. Service seafood department and deli using same scales	x		
13. Oysters, fresh or frozen, which are leaching a red color			x

PRODUCT SHRINK

Few factors rob profits from food retailers as directly as shrinkage. It can be defined either as the difference between the weight of seafood purchased and the weight of seafood sold, or in terms of dollars, margin shrinkage due to loss and markdowns. Product losses may result from spoilage and physical damage (discards), poor cutting yield, dehydration, drip and theft.

A survey by Food Marketing Institute revealed a strong correlation between display size and shrinkage. Stores with long full-service seafood case frontages indicated an overall shrinkage rate of 15 percent while those with small departments experienced just 5 percent.⁵ Interestingly, the reverse was true for self-service operations. Apparently stores with small self-service departments are less effective than larger ones at turning inventory and often contend with increased shrink.

Although large service displays lend themselves to attractive merchandising techniques, they require a great deal of work and total commitment by management. Increased time in the case will translate to increased shrink. For specific control measures see "Recommendations for handling seafood" and "Retail Display Cases".

Not all shrink is as obvious as spoiled or dead products. Some important sources are insidious because they often go undetected. They include short thaw weights related to heavy glazing, poor yields due to inexperienced cutters or soft fish, and moisture loss during storage.

As fresh seafoods lose quality they also lose their ability to hold water, accelerating drip loss. This is readily apparent in oyster meats but is equally true in other shellfish and finfish. Drip and dehydration may be substantial. Cooked shrimp may lose 15 percent of their weight within three days and raw shrimp considerably more. Fish fillets and steaks are very vulnerable to drip, and the amount for one species may be double that of another. Experience is the best teacher here.

⁵1987. Retail Seafood Study. Food Marketing Institute and the Gulf & South Atlantic Fisheries Development Foundation, Inc.

Reducing Discards

In order to reduce product losses due to quality deterioration, and/or the loss of customers due to purchase of poor quality product, the following alternatives are suggested:

1. Buy no more than what can be sold quickly. This is the most obvious solution but is not always possible. Still, sales volume can be most readily anticipated if accurate records are kept that allow buyers to monitor the effects of season and store promotions on customer demand.

2. Products which have been in a properly cooled display case for 48 hours without being sold can be over-wrapped, frozen and merchandised as fresh frozen product. Use appropriate packaging materials and freeze quickly, exposing the packages to moving air at or below -10° F. See "Seafood other than 'Fresh' Products: Frozen Seafood".

3. Stores that offer value-added products or have delis may elect to make these seafoods into fish salads or other prepared items. Don't overlook the opportunities to recover trimmings, especially from large fish. As John Maki points out, "Clever retailers will merchandise it as stir fry or chowder meat." ⁶ See "Seafood other than 'Fresh' Products: Value-added Products Made in Retail Seafood Departments"

4. Markdowns and promotions may help to move inventory while it is still of high quality. However, some retailers feel that the practice of price discounting projects an undesirable image, particularly in upscale markets.

A record of all discards may, with time, show wasteful patterns that can then be corrected. Also periodically check thaw and cutting yields to be certain that pricing is based on actual product costs.

For a discussion of the effects of shrink on department profitability, see "Margin Management Tools".

⁶Maki, J. Cutting shrink down to size. Seafood Business Report, November/December, 1987.

QUALITY CRITERIA

Fresh Whole Fish

	Fresh	Reject
General Appearance	Bright with metallic luster. Very little if any, fading	Bloom completely gone. Color faded
Eyes	Bright, translucent, usually full but in some cases may be slightly sunken and somewhat dull	Dull and sunken. May be cloudy, pink, white or opaque
Gills: Color	Bright red to slightly pinkish red	Brownish red to brown or gray. Frequently covered with thick mucus.
Odor	Fresh odor - characteristic of species to faint sour odor	Medium to strong sour odor
Odor	Fresh, sea-like or or grassy, to no odor	Medium to strong sour, putrid or ammonia-like odors
Consistency of Fish	Firm and elastic to the touch. Occasionally may be slightly soft	Generally soft and flabby, separating from bones
Belly Cavity	Flesh adheres firmly to rib bones	Rib bones free or almost free from flesh. Brown or yellowish discoloration.
Vent	Normal in shape and color	Protruding and may be discolored

Fillets and Steaks

Often people indicate they have a problem in determining the quality of fillets or steaks since the usual indicators (i.e., eyes, gills, etc.) are missing. While it may be a little more difficult to judge quality of steaks and fillets, the following guidelines should be useful.

	Fresh	Reject
Odor	Fresh and mild	Medium to strong, sour, or putrid
Consistency	Firm and elastic	Soft and mushy
	Skinless fillets may not be quite as elastic as fillets with skin on	
Color	Color will vary according to species, experience with each species will help you spot discoloration which you want to avoid	

Live Shellfish

Indicators

Crabs and Lobsters	Must show leg movement (although cold animals will be lethargic), also live lobsters curl their tail under the body when held, a dead lobster's tail hangs down, as do the claws of a dead crab.
Oysters and Clams	Shells must be tightly closed, any shell which does not close when lightly tapped indicates the animal is dead and should no longer be considered as edible. Also discard animals with cracked shells.

Shucked Shellfish

Indicators

Oysters

Fresh oysters should be plump and have a natural creamy color, although some oysters have a natural tan, brown, or black film over the mantle. The liquid should be clear or slightly opalescent, free of shell particles, with no sour smell.

Eastern oysters are generally packed and graded according to the numbers of meats to the gallon. Actual counts may vary however, since standards of identity have not been promulgated into law.

<u>Grade</u>	<u>Meats per gallon</u>
Very Small	over 500
Small or Standard	301 to 500
Select or Medium	211 to 300
Extra Select or Large	160 to 210
Counts or Extra Large	under 160

Color variations: The normal color of fresh raw shucked oysters is variously described as creamy, gray, brownish, pale yellow, or some combination of these. However, other colors may not indicate spoilage. Other colors may include: green, red, brown spot, and pink.

Clams

Fresh clams should be plump, with clear liquor, free of shell particles, and a mild color. Clam color may vary depending on species.

RECOMMENDATIONS FOR HANDLING SEAFOOD

Receiving and Storage

1. Set criterion for and record product temperature and condition at the time of delivery. An experienced individual should have authority to reject shipments that do not meet company standards, for example, fresh fish above 40° F. Be careful when accepting cooked or ready-to-eat seafood which has been shipped on trucks with live or uncooked products.
2. After inspection, re-ice seafood if necessary and move it to the cooler. Washing fish in a tub or with a hose is unlikely to help and may only warm them and accelerate spoilage.
3. Segregate products in the cooler so that shellfish and ready-to-eat items cannot contact drip from fish or raw crabs. As mentioned elsewhere in this manual, failure to do this has caused numerous outbreaks of food-borne illness.
4. Keep the cooler set between 35° and 40° F, making sure whole and dressed fish and packaged shellfish meats are surrounded with ice. Leave fillets in plastic bags or, better yet, place them in shallow, rigid containers, then surround with ice. Handle the products as little as possible.
5. Live shellfish should be kept moist by covering with damp bedding material, even single-service toweling. Place them in the warmest or least drafty part of the cooler. Leave mud on oysters until just prior to displaying. Never hold clams, oysters or mussels in water or buried in ice.
6. Be generous when estimating future needs for ice-making capacity. Seafood markets require more ice than many managers anticipate. If necessary, make extra ice by emptying the bin each evening (scoop it into clean, large plastic tubs), storing it in the cooler and allowing the bin to refill overnight. Some ice machines are designed to allow for replacing a full bin with an empty one.
7. Use only ice made from drinking water and never reuse after it has been in contact with seafood or contaminated surfaces.

Processing

1. Value-added products, such as seafood salads and deli style items should be prepared in the same location each day; an area away from the fish cutting station, if possible. Because space is often at a premium, if these products must be prepared in locations used for other purposes, be particularly careful to thoroughly clean and sanitize the area and all implements before starting. See "Seafood other than fresh products; Value-added products made at store level."
2. Fish cutting operations as well as value-added preparation should be expedited so that products are handled and warmed as little as possible.

Display

1. Wash seafood in cold water before placing it in the case.
2. Display whole and dressed fish in a single layer with some ice on top. Dressed fish should be oriented with the belly cavity down to prevent the formation of stagnant pools.
3. Fillets may absorb water and become very soft if buried directly in ice. Display them in shallow pans (containing drain holes) nestled in ice or on a sheet of plastic film on a bed of ice. You may wish to stretch more film over the top as well to reduce drying.
4. Dehydration makes seafood look old, leads to considerable loss as shrink and kills shellfish. Periodically mist with ice water, use some ice on top where possible and, in the case of live shellfish, display on damp green garnishes and mist lightly or use just a little ice. They may die if buried in ice.
5. Set the iced case at about 35°F. If set colder the ice may not melt fast enough to keep the drain lines flushed, which could lead to fishy odors.
6. When selling from and replenishing the display, follow a first-in-first-out procedure.
7. Some retailers "wash" their seafood in a light salt solution at the end of each day. This gives fish a glossy appearance and may firm the texture slightly but it will not extend shelf-life. If you do this,

dissolve the salt first (about 1/2 cup per gallon) then add ice to chill it. Do not allow the fish, especially fillets, to sit in this solution for much more than a minute or two or they will pick up salt.

8. One convenient method for holding seafood overnight is leaving it right in the display case. Cover the bowls or pans containing the displayed products and put a top layer of ice over the entire display. Then simply uncover the next morning and spruce with fresh garnish and products as needed. Although a simple technique, it proved to be very successful in a study by researchers at Texas A & M.⁷
9. Completely empty the fresh seafood case of ice, then clean and sanitize at least once per week for refrigerated cases and every one or two days for unrefrigerated cases. A survey by Food Marketing Institute indicated that many retailers are able to clean even more frequently than this.⁸
10. Cases used to display value-added products should be set near 32° F.
11. Be careful to segregate raw and ready-to-eat products and set-up cases so that raw seafood is not passed over prepared products when the cases are worked. Watch out for other chances for cross-contamination, such as using the same serving implement for more than one product and placing products directly on dirty weigh scale pans.
12. Packaging: Never present the customer with their purchase in thin, hastily wrapped paper. A leaky or torn package is not only messy but unappetizing. Place the seafood in a plastic bag or rigid container first, then over-wrap if necessary. During hot summer days, it is also wise to place bagged seafood inside another plastic bag containing ice, tie it securely then insulate with paper or a single service carton.
13. From a merchandising perspective, many factors may

⁷Miget, R., T. Wagner and M. Haby. 1987. Determination of Optimal Display Procedures for Fresh and Previously Frozen Seafoods Using Ice-only Cases and Seafood Cases which Require Supplemental Refrigeration. Texas A & M, final report to the Gulf & South Atlantic Fisheries Development Foundation, Inc.

⁸1987. Retail Seafood Study. Food Marketing Institute and the Gulf & South Atlantic Fisheries Development Foundation, Inc.

effect the selection of products and their placement in the display cases. If you would like suggestions in addition to those offered in this manual, contact the authors at Virginia Tech or the Mid-Atlantic Fisheries Development Foundation.

Sanitizers

Three types of sanitizers are commonly used; hypochlorites (chlorine), iodophors (iodine) and quats (quaternary ammonium compounds). In several respects, iodophors are probably the most useful. They work about as well as hypochlorites but are less caustic and are kept easily at full strength. When the solution changes from a golden color to straw-yellow it's time to replace it with fresh sanitizer.

Quats are useful for retail case drain lines, floor drain traps, floors and coolers where their extended residual action helps control odors. They take longer than other sanitizers to kill bacteria and are probably less suitable for routine use, such as for cutting boards, knives, weigh scales, etc.

For a detailed discussion of sanitation see Appendix V.

RETAIL DISPLAY CASES

In retail display cases a compromise must be achieved between what is best for the product and what is best for merchandising. Ideally we should completely bury whole fish in ice but customers won't buy what they can't see. This makes product management in the case a critical step in the successful operation of a retail department.

Texas A & M specialists have observed that the air just two inches above a bed of ice in an unrefrigerated case may be at room temperature.⁹ Similarly, researchers at Virginia Tech have recorded as much as a 25°F difference between the bottom and top of a stack of flounder fillets piled on ice. Obviously this is not acceptable.

Simply laying the fillets in a single layer nearly eliminates this temperature difference, even if the fillets are

⁹Miget, R., T. Wagner and M. Haby. 1987. Determination of Optimal Display Procedures for Fresh and Previously Frozen Seafoods Using Ice-only Cases and Seafood Cases which Require Supplemental Refrigeration. Texas A & M, final report to the Gulf & South Atlantic Fisheries Development Foundation, Inc.

allowed to overlap. Even so, during shopping hours the retail case is seldom as effective as the storage cooler for maintaining quality. Monitor temperatures closely and keep displays of slow moving products small.

Case Design and Maintenance

Many different case styles are available to retailers, from open ice-only designs to closed refrigerated meat cases. Most can be used successfully but only when compatible with product turnover rates and management practices.

Open cases that rely solely on ice for cooling are usually found in specialty fish markets or are used for small shellfish displays in supermarkets. Their effectiveness is determined by design and placement. Cold air sinks and will spill off the lowest side of the display unless it is retained by a barrier such as a vertical lip rising above the seafood load level.

Modern European style cases often contain no supplemental refrigeration. Typically, an ice bed slopes toward the front of the case where a clear shield angles up and back. This design traps some of the air cooled by the ice. However, the temperature balance may be disrupted by warm air currents created when the case is worked or by fans, heaters, ice-making machines, etc. Completely enclosed cases generally allow for more temperature and humidity control than do those that are open on the top or back.

Ice-only cases should only be used when seafood turnover is rapid or when products are heavily iced at all times. Cases that use both ice and supplemental refrigeration probably produce the longest product shelf-life for most seafood departments. Since weight losses are aggravated by the drying effect of refrigeration, some newer units also offer humidification features.

Regardless of basic design, retail cases should be properly maintained for effective operation. Damaged or corroded construction materials can trap seafood drip or particles and be nearly impossible to sanitize. This is true for small or twisted drain lines as well.

Also, investigators have noted that refrigeration may account for nearly half of the energy costs in food retail operations, twice as much as for air conditioning.¹⁰ Several problems commonly encountered with refrigerated display units may

¹⁰Carroll, J., B. Hodge, W. Steele and R. King. 1985. Energy Conservation in Convenience Stores. Mississippi Cooperative Extension Service publication #1497.

result in more than 30 percent wasted energy, according to a study by the Louisiana Cooperative Extension Service.¹¹ They include damaged equipment (e.g. bent fan blades), dirty condenser and evaporator coils and improper installation. Energy costs can be reduced substantially merely by positioning cases so that air is drawn unrestricted over condensing units.

SEAFOOD OTHER THAN "FRESH" PRODUCTS

Smoked Seafood

Smoked fish is generally perceived as a luxury food, described by connoisseurs in complex terms more often reserved for fine wine or caviar evaluations than for fish. This is just fine for retailers who may realize larger margins on smoked fishery products than on their unprocessed counterparts. Sales of smoked fish are growing. In upscale markets especially, it is perceived by consumers to be convenient and gourmet. Considering this trend, it may seem odd that some seafood retailers do not carry a single smoked fish item, particularly in certain areas of the country.

Products: Wherever fish are smoked commercially, the most popular species is salmon. Lox is mildly salt cured salmon which may or may not be smoked. Nova (or Nova lox) is similar but is always smoked. In the midwest and on the east coast, chub, a small freshwater whitefish, is also popular. In the east look for smoked haddock (finnan haddie) and cod. On the west coast, sablefish is highly regarded in its smoked form. Retailers should consider other species when available. Shad, bluefish, whiting and eel are a few in a long list of species excellent for smoking. Depending on species and custom, market forms are most often drawn, headed and gutted, split, chunked or filleted. Smoked shellfish include oysters, clams, shrimp, crab and squid.

Two basic products are available; cold smoked and hot smoked. The former is basically raw and the latter is cooked. Both require an initial salt cure followed by the application of wood smoke.

Shelf-Life: Smoked fish have shelf-lives comparable to fresh products and should be stored at 28° to 32° F. Retailers seldom

¹¹Bankston, J., F. Baker, M. Miller and G. Johnson. 1986. A Result Demonstration in Small Grocery Stores/Seafood Markets Refrigeration Servicing. Louisiana Cooperative Extension Service.

have more than 5-7 days to move them. Handle smoked fish as little as possible and protect them from condensation. They should not be misted. The association of hot smoked fish with botulism poisoning makes proper temperature control imperative. The benefits derived from salt, moderate drying and smoke (which contains phenolic compounds, formaldehyde and other inhibitors of bacterial growth) are slight and largely offset by the susceptibility of cooked seafoods to spoil. Modern cold smoked fish are generally too lightly cured to significantly extend shelf-life.

Nearly all smoked products can be successfully frozen if necessary, however, they will not maintain quality as long as unprocessed fish and are best used within three months. Use only the finest freezer packaging available. Be aware that lengthy storage, whether chilled or frozen, will weaken the smoked flavor. **Thaw under refrigeration.** Do not risk serious health problems by exposing to warmer temperatures. Water droplets should be carefully blotted off the surface because moisture can leave a dull appearance.

Things To Look For:

Appearance: Ideally, hot smoked fish will be smooth, shiny and golden brown in color. For safety reasons FDA guidelines call for a high temperature process that may not produce a pretty product. Some processors may opt for lower temperatures which are permitted only if salt content is at least five percent. These fish should have a uniform glossy caramel color characteristic of the finest smoked fish. There should be no signs of improperly cleaned fish or white patches (a sign of excess salt).

Texture: Hot smoked fish should have a thin chewy, but not tough, "skin" and a moist interior. Too much drying during initial stages of processing may lead to a leathery exterior; a condition known as case hardening. A soft, mushy texture indicates either improper smoking practices or poor quality raw material.

Flavor: Smoked fish should have a well balanced flavor, not bitter or harsh. Salt is necessary to establish the glossy surface (pellicle) responsible for color development, moisture retention and absorption of smoke but it should not overpower other flavors. Appearance, texture and flavor usually go together. If it looks good it's likely to taste good.

Merchandising: Even people who seldom eat fish are often impressed by smoked seafoods. Try in-store demonstrations with hot smoked fish served on crackers or substituted for tuna in salad. Encourage customers to be creative. Smoked products can be poached, baked or used in stuffings, as well as eaten cold. They are perfect for making into value-added items.

Surimi

Surimi is an intermediate product used in the formulation of simulated seafoods. The term surimi comes from the Japanese, who developed this method of seafood preservation. Surimi is actually a fish "paste" made by mincing fish, washing the mince and adding sugar or sorbitol to preserve the texture of the paste during freezing. The product can be shipped in this form to other manufacturers or thawed and further processed at the same facility. When thawed, artificial and natural flavors, salt, and 0-35% natural crabmeat or other seafoods are added. The exact formula depends on the manufacturer and the end product desired. Next the product is shaped and breaded or colored to finish the simulation.

Currently, the most common source for surimi is Alaskan pollock, which is a member of the cod family but less expensive and more plentiful than cod. Other species of fish are now being researched in this country for their potential use in surimi and surimi-based products. Among these species are freshwater catfish, red hake, menhaden, silver hake and croaker. All of these species are plentiful and inexpensive, two very important considerations to the surimi manufacturer.

Most frozen surimi-based products are imported from Japan. However, an increased proportion of frozen surimi is now imported for further processing by U.S. manufacturers. Crabmeat, scallops, shrimp and lobster are the most commonly simulated products. Common market forms include thawed and frozen tails, sticks, legs, flakes, chunks and pre-breaded morsels and portions. Most of the products are precooked and therefore can be used as is in cold appetizers or salads, or simply heated when served hot.

Some common market names for surimi-based products include; Sea Stix, Sea Legs, King Krab, Ocean Magic, Nuwave Seafood Sections and Delicaseseas.

Surimi-based products, like the products they simulate, are low in fat and calories. They are also low in cholesterol, however, they are higher in carbohydrates and sodium (due to the addition of sodium based ingredients that are added during processing) than their natural counterparts. The surimi-based products contain high quality proteins, although the total amount of protein may be slightly lower than the protein content of the seafood they are imitating.

These products should be treated similar to other frozen / thawed products. Remember, surimi is ready to eat and, as such, should be separated from raw seafoods to prevent cross-contamination as you would other items that require no additional cooking.

**APPROXIMATE NUTRIENT CONTENT OF FOUR SURIMI-BASED PRODUCTS
COMPARED TO ALASKAN KING CRAB LEG MEAT**

	1 ^a	2 ^a	3 ^a	4 ^a	5 ^b
Nutrient	Amount per 100 grams				
Calories	87	73	93	96	97
Protein, gm	13.0	12.0	11.7	15.2	19.4
Fat, gm	0.1	0.7	0.9	0.9	1.5
Carbohydrate, gm	8.6	4.7 ^d	9.5 ^d	6.8	0.0
Cholesterol, mg	<1	N/A	N/A	30	53
Calcium, mg	12	626	35	9	59
Phosphorus, mg	N/A	106	N/A	N/A	280
Iron, mg	0.2	0.6	0.4	0.3	0.8
Sodium, mg	1085	725	604	143	1,072
Vitamin A, I.U.	50	90	N/A	N/A	133
Thiamin, mg	0.06	0.03	N/A	0.02	0.05
Riboflavin, mg	0.04	0.06	N/A	0.02	0.05
Niacin, mg	0.38	N/A	N/A	0.22	1.34

^a Four brands of surimi-based crabmeat, published in:
Nettleton, Joyce. 1985. Seafood Nutrient: Facts, Issues
and Marketing of Nutrition in Fish and Shellfish. Osprey
Books, Huntington, NY.

^b Alaskan King Crab Legs, cooked by moist heat: Composition of
Foods: Finfish and Shellfish Products. USDA Handbook
Number 8-15.

^c Approximately 3 1/2 ounces

^d Estimated by difference.

Pasteurized Crabmeat

Pasteurization is one of the most significant advances in the blue crab industry in many years. The taste and overall quality of pasteurized crabmeat is generally indistinguishable from fresh meat. It is produced by heating crabmeat packed in cans to an internal temperature of approximately 185° F, then cooling in ice water.

There are many advantages to purchasing pasteurized crabmeat, especially in the winter. During the colder months, crabs dig into the sandy bottom and much of the fresh crabmeat may be gritty. Most pasteurized crabmeat available at this time was packed in the warmer months when a surplus of crabs was being harvested.

Pasteurized crabmeat also has a much longer shelf-life than fresh packed crabmeat. The maximum shelf-life expected from fresh crabmeat is 7-10 days from when it is received; whereas, pasteurized meat may be kept 6 to 12 months under refrigeration. As with other pasteurized products, such as canned ham, this type of crabmeat must be stored well chilled -- 34° F is recommended.

Although pasteurized crabmeat has an excellent health safety record, it is a **potentially dangerous product if temperature abused**. It is recommended that only refrigerated cases be used for self-service displays, not the familiar ice-only island cases.

Pasteurized crabmeat can be promoted to customers as a convenience food since it can be kept on hand until needed. It is especially handy during the holiday season when they receive unexpected guests. Furthermore, home freezing of crabmeat is not recommended unless it is partially prepared as in crab cakes or in a casserole. This pre-preparation may limit usage at a later date.

Once a can of pasteurized crabmeat is opened it should be handled as if it were fresh and used within 2 or 3 days. Occasionally, some of the meat may take on a blue-gray color. This color variation results from heat processing and does not affect eating quality.

Pasteurized crabmeat is also comparable to fresh crabmeat nutritionally. Both provide about 18 percent protein and only 2.5 percent fat. A 3-1/2 ounce serving of crabmeat contains only 78 Calories and about 80 mg cholesterol.

The market forms available are the same as for fresh meat; backfin/lump, special/flake, claw and cocktail claw. Customers may still be hesitant to purchase pasteurized crabmeat due to inexperience with the product. Encourage them to use pasteurized crabmeat as they would use fresh meat.

Frozen Seafood

Most seafood retailers use freezer units for storing and displaying their traditional frozen line and for inventory control of products to be slacked off. This section will emphasize the first use: buying and marketing items sold from a frozen food retail case. Quality indicators are summarized in the table that follows.

Packaging: When buying frozen seafood note the type of packaging materials used and its integrity. Compare competitors. Look for packaging that forms tightly over the product, is durable and free of breaks. A few years ago a midwest processor tried a package similar to those used to pack chubs of fresh pork sausage. Although heavy and tight fitting, the package soon developed pinholes when handled at low temperatures.

A suitable package might consist of a freezer quality cling wrap overlaid with a protective plastic film or carton. Vacuum packages are especially good. However, ideal packaging from a quality perspective is often tempered by economic practicality. Only large margin items can absorb the cost of the most expensive packages. Also seafood with a fast turnover rate may not require packaging designed for lengthy storage.

Plastic films vary greatly in quality, so familiarize yourself with their attributes and consult seafood suppliers to determine the type of packaging materials they use. Refer to appendix VI for detailed information of package properties.

Fish may be sold in plastic sleeves that are simply folded under rather than sealed. Check these carefully. They should be well glazed. An ice glaze is an effective barrier against moisture loss and infusion of oxygen, which causes rancidity, but is lost with time and often cracks or falls off. When this occurs fish are highly susceptible to freezerburn and development of off flavors.

Some shellfish are marketed as frozen blocks in unsealed cardboard cartons. Periodically inspect the block surface for dry areas during storage. Sprinkle the block with water to form a thin glaze when needed to avoid freezerburn.

Heavy glazes are not recommended due to possible customer

dissatisfaction with excess drip when thawed. Also certain products may not be legally glazed in some states because of net weight considerations. If in doubt, check with appropriate regulatory agencies before purchasing glazed seafood for direct retail.

Judging Quality: When taking delivery of frozen seafood evaluate color and appearance, and look for indications of extended storage or temperature abuse. Frozen fish should appear much like fresh fish. Frost or "snow" in a package is often moisture that has migrated out of the product during storage. If excessive, the flesh will be dry and bland when prepared. Extreme dehydration results in freezerburn, recognized by dry white or yellowish patches. This condition is usually traced to loose fitting or damaged packaging.

Frozen puddles or runny skin color is evidence of, at least, partial thawing and refreezing. The extent of damage may be difficult to assess and the shipment should be rejected. All frozen products should be less than 15° F and feel firm when received. When possible, check product temperature with a thermometer (metal probe type or digital thermometers are more durable than glass). Preferably frozen seafood should be held at 0° to -10°F where it will maintain quality twice as long as at 10° to 15°F.

The presence of brown or yellowish discoloration indicates age and is often associated with rancid or cardboard-like flavors. If suspect, sample the product: thaw some and evaluate odor and appearance raw then cook and taste it without seasoning. As with fresh seafood, a reasonable but discerning seafood buyer gains respect from suppliers and may find the quality of his line improve without perpetual harping.

The Retail Freezer Case: By its nature the frozen food department often gets less daily attention than the fresh seafood case. However product mix, organization and appearance are just as important. The frozen line offers an opportunity to add an exotic touch not always possible with fresh seafood. Gourmet items such as octopus and escargot may be slow movers but often carry attractive margins and help establish a reputation for the unusual. Of course product mix will depend largely on trade area and the market segment targeted.

Pay attention to case appearance. Frozen seafood is frequently sold directly from shipping cartons, including crab legs and other big ticket items. Such seafoods generally warrant more attractive partitioning that blends well with the other products.

Select colorful seafoods and packaging when possible. Rich color combined with neatness and cleanliness connote quality to

customers -- an indication of management concern. Point of purchase information cards, posters and well-prepared signs draw attention to specials or help shoppers make selections. This is especially helpful when customers routinely ignore the frozen seafood department. Observe traffic flow patterns and adjust product display location if needed to improve visibility.

Keep freezer cases in good operating condition. Defrost cycles should be adjusted to minimize temperature fluctuations, yet function as designed. Condenser coils should be periodically cleaned to reduce energy consumption. And always keep products within the load level line to prevent warming.

When quality and merchandizing techniques are given serious consideration frozen seafoods can contribute appreciably to profitability. This should prove true even in coastal communities known primarily for fresh seafood.

DEFECTS IN FROZEN SEAFOODS

<u>Description</u>	<u>Cause</u>	<u>Implications/Things To Check</u>
Strong Fishy odor; rancid or cardboard like flavors; yellow or brown discoloration.	Fat Oxidation: chemical reaction with oxygen; may involve metals or light.	Poor package integrity, tightness of fit or type of material; excessive length of storage; susceptible species.
Toughening; excessive drip or soggy though chewy; bland flavor.	Protein denaturation; chemical cross-linking between protein components.	Slow freezing rate or warm storage; fluctuating temperature; poor quality product prior to freezing; refrozen product; excessive length of storage; susceptible species.
Light colored areas appearing dry.	Freezerburn: dehydration; extreme form of protein denaturation.	Damaged or improper package; loss of ice glaze.
Soft texture.	Structural damage due to large ice crystals or bruising; enzymatic softening or seasonal effect.	Slow freezing rate and fluctuating temperature; poor quality of product prior to freezing; refrozen product; susceptible species and season; presence of parasites (rare).
Frost or "snow" in package.	Migration of moisture from product and reformation of crystals.	Excessive length of storage; loose fitting package; refrozen product.
Ice "slicks" in package.	Frozen free liquid.	Product refrozen or excess water included when packed.
Runny skin colors.	Rupture of pigment cells.	Refrozen product.
Brown discoloration.	Chemical browning reaction (or sometimes darkening due to dehydration).	Excessive length of storage or any factors associated with fat oxidation; black spot in shrimp.

DEFECTS IN FROZEN SEAFOODS (continued)

Description	Cause	Implications/Things To Check
Ammonia, putrid or or sour odor.	Bacterial spoilage.	Poor quality prior to freezing.
Breeding defects.	-----	Ice-filled voids steam off when cooked; physical damage.
Pronounced saltiness, especially in shrimp and other crustaceans.	Brine freezing, usually on fishing vessel.	Excessive exposure to brine.

Value-added Products Made in Retail Seafood Departments

Increasingly retail seafood stores are processing their own finished products for sale in the fresh seafood department. These products include spiced shrimp, marinated fillets and deli-like entrees. Despite considerable interest, many questions remain unanswered since few organizations have addressed the practice in depth. This section examines the topic based on store surveys and product development studies.¹²

There may be several good reasons for retailers to process their own convenience seafood products:

1. Suppliers of preprocessed fresh items may be difficult to find.
2. Sales of value-added fresh meats and seafood have increased appreciably in many market areas.
3. Margins may be larger on these products.
4. They broaden product mix and services.
5. They satisfy the customer's desire for convenience, especially in upscale markets. Stated differently, they reduce the customer's risk of being disappointed in the kitchen.
6. They may favorably impact department image or theme.
7. Some seasonings or sauces used in value-added products may mask or complement seafood having a naturally strong flavor or dark color.
8. Finished products downplay seafood species identity and consequently facilitate substitutions. This may help overcome problems with seasonal supply shortages and encourage consumption of unfamiliar species.

Before embarking on store renovations and advertising however, retailers should evaluate their operations and marketing area closely. In-store preparation of value-added products may be very successful for some stores but not others depending on store design, management commitment and sales potential. A few of the disadvantages of making finished products at the retail level are:

¹Conducted by Virginia Polytechnic Institute and State University Extension Division, Virginia Sea Grant College Program and Lawler Ballard Advertising, in cooperation with the Virginia Marine Products Board.

1. They require additional time and reliable labor -- commodities often scarce in retail operations.
2. They may require an investment in equipment and facilities.
3. They increase the risks of food-borne illness, especially when ready-to-eat products, like steamed shellfish or salads, are prepared or stored in proximity to raw seafoods.
4. They may not be suitable for some market areas.

Facilities: Physical facilities vary greatly among stores. Specialty seafood markets are most likely to have large back rooms with a wash down area, large capacity ice machine and one or more coolers. Seafood departments within supermarkets, however, may have no back room at all. Even full service operations may locate preparation areas immediately behind the retail counter and share cooler space with meats and poultry.

Further processed products can be prepared in most department settings, but there are distinctions between these seafoods and those that are unfinished. Aesthetically, visibility of the processing area from the showroom may be desirable for custom fish cutting but undesirable for the preparation of value-added products. Also, although nearly all raw products can be cut on one table, processed products usually require a separate work station.

Preparing convenience items often requires equipment not normally found in fresh seafood departments. The following list is not exhaustive. Some articles may not be necessary for all products, while others may be used elsewhere in the department or perhaps shared with another department. Each operation should be evaluated independently, keeping in mind space limitations, the services and products to be offered, and potential sources of contamination.

Facilities and equipment include:

1. Clean, enclosed storage areas for spices, packaging materials, sales aids, and other dry goods.
2. Refrigerated storage (30° to 35° F) for fresh seafood and perishable ingredients. Separate coolers should be used for raw and ready-to-eat products. Using different areas of the same cooler provides sufficient partitioning between raw seafoods and those value-added items that require cooking by the consumer.
3. At least one work station used only for preparing further processed products or, if shared with cutting area, used

only after table and utensils are cleaned and sanitized.

4. An assortment of utensils. (Stainless steel or plastic are preferred to other metals, wood or glass.) These articles include mixing spoons, knives, cutting boards, spatulas, measuring spoons and cups, pans, trays, bowls, etc.
5. Medium-weight commercial food processing equipment: slicer, mixer, blender, chopper, dicer, grinder and / or multiple purpose equipment with accessories.
6. Over-wrap or shrink-wrap equipment with trays, absorbent pads and gas permeable plastic film.
7. Steam cookers.
8. Electric hot pots used for holding chowders and gumbos.
9. Other heating and warming equipment used for hot foods as part of a well equipped kitchen.

Tailoring Products to the Department: As with other innovations, management may wish to offer further processed items on a limited scale initially to assess market potential. Capital investment is kept small and the incremental cost of hiring extra help may be deferred. However, if this strategy is followed, certain products will most readily lend themselves to a given department layout.

Both service and self-service departments can successfully process similar items; store facilities are generally more limiting.

1. Stores characterized by one small work area and limited cooler facilities should use the services of a central kitchen or commissary, if possible, or have products prepared by the deli department. If products must be produced in the fresh seafood section, make only ready-to-cook (raw) items, and devote preparation to one time of day after work station and utensils are cleaned and sanitized.

2. Departments similar to those described above but having an area dedicated to value-added processing should also stay with ready-to-cook products but preparation schedules can be more flexible. Custom steaming of shrimp and lobsters can be a successful service if sanitation procedures are closely followed and care is taken to avoid cross-contamination.

3. If separate cooler and processing facilities exist for raw and finished items, both ready-to-cook and ready-to-eat products can be marketed successfully.

4. Hot deli style entrees should be left to departments having access to true kitchens.

Successful merchandisers of fresh seafood have learned the importance of quality. As discussed in appendix IV, seafood has a short shelf-life compared to many other foods due to its unique physical, chemical and microbial properties. In addition, other quality concerns become important to retailers who process their own value-added products.

Achieving consistent product quality from one batch to the next requires close attention. Make recipes the same way each time and of the same batch size, or test formulations for several batch sizes. Use substitute ingredients only when results can be predicted. Commercial food processors sometimes vary ingredients based on least cost formulation -- a difficult practice demanding tight quality control and experience. Also, use only high quality ingredients. Many seasonings lose flavor intensity during storage (including wood smoke) while others become stronger or off-flavored, such as onion.

Product Quality -- A Shelf-life Study: Texture, appearance, odor and flavor may all change during storage. Although some retailers may choose to discard unsold products at the end of each day, others will want to hold them based on a known shelf-life. This is especially useful when products are tray packed for self-service. To determine the effect of several fish preparations on shelf-life, a study was conducted at the Virginia Tech Seafood Experiment Station. The results of the study are described at length in appendix VII.

The findings suggest that many factors affect the quality of value-added items; some related to the seafood and others to ingredients. Initial impression will make those important first sales but only a pleasant experience at the table will bring customers back. The shelf-life of seafoods may be extended or shortened by using them in convenience products but best results will always be achieved by preparing relatively small batches that can be sold quickly. Ingredients should not be relied on to preserve quality.

Safety Considerations: As discussed in the section on sanitation, cross-contamination of one product with another can lead to illness. The opportunities for this development are compounded when retailers process their own value-added products. Be particularly aware of work stations, storage areas, retail cases and utensils used for both raw seafoods and cooked or ready-to-eat items. Even retailers who carry very few value-added products often steam their own shrimp and lobsters. Disease-causing microorganisms can become established if contaminated by

raw seafood.

Store finished and raw materials in separate coolers or at least isolate them in different areas of one cooler (not just different shelves on the same rack). Place cooked items in sealable containers and cover loosely in the cooler until chilled, then close tightly. Separation in the sales area can be achieved by locating susceptible products in their own case, by partitioning with "plexiglass" dividers, by adding a decorative non-seafood buffer zone or by placing them on a shelf above raw products such that contact with a dropped or misplaced raw item is unlikely.

Temperature control is also critical, especially when foods pass through the range of 45° to 140° F. Prepare products quickly to minimize warming and return them to the cooler without delay. Containers of warm seafoods can be surrounded with crushed ice to expedite cooling. Although seafood is normally safe if not allowed to rise above 40° to 45° F., best shelf-life is possible only below 35° F. Truly cold products will also provide a margin of safety while customers are in route home. If hot soups or deli foods are offered they must be held hotter than 140° F.

APPENDICES

APPENDIX I

THE PURCHASE DECISION PROCESS: EDIBILITY SIMILARITIES IN SEAFOODS AND VALUE

INTRODUCTION

All consumers evaluate their options before actually making a purchase. This evaluation procedure may be completed subconsciously in seconds for certain so-called routine or impulsively purchased items or may require active, focused thought over the course of days or weeks for the purchase of durable goods. For food products the evaluation procedure involves answering several questions:

- (1) What is this item?
- (2) Do I know the best way to prepare it?
- (3) Will my family enjoy it?
- (4) Is it within my budget constraint?
- (5) If I do not purchase this item what are my alternatives?

Essentially these five questions relate to the issues of product acceptance and affordability. Consumers will purchase only those seafood products which simultaneously achieve these two goals. The first goal is product acceptability. Consumers must be familiar with the product so that they understand how to incorporate it into a recipe.

Additionally, consumers must feel positive about how they presume the finished product will taste to family and friends. If either of these components of acceptance is negative or questionable, in most cases the product under evaluation will not be selected.

Product affordability is another objective that must be addressed. Quite often consumers find the objectives of acceptability and affordability mutually exclusive for seafoods. When only one of the purchase objectives is achieved, the purchase decision is simple: "Don't buy fish". For example, swordfish is certainly an acceptable product; but, priced in the \$9 - \$10 per pound range, it does not meet the test of being affordable for many consumers. On the other hand, shark steaks are economically priced, but if consumers are not certain about this product's edibility profile, preparation method, etc. shark may not be purchased.

Realizing that these two objectives combine to influence a purchase decision is critical considering the normal

operating conditions present in the seafood marketing and utilization system. First, seafood has the most diverse product line of any meat item, yet typical consumer knowledge of marine food products often is limited to regional favorites. Generally, these regional favorites are among the higher priced items in the local seafood mix.

Second, fluctuations in seafood supply (and therefore prices) are more dramatic than for other meat items. This situation is common for many of the more "acceptable" seafoods and may negatively influence consumer purchase decisions. However, those seafood products which do not experience great price changes are usually in the questionably acceptable (or unacceptable) category. As more seafood is consumed, prices may increase further for those "acceptable" products, placing them beyond the budget constraint for a large segment of the population.¹³ Therefore, consumers must learn to utilize a wider range of products if they are to take advantage of seafood's inherent nutritional benefits while still realizing an economic value in its purchase. To do this the consuming public needs to become more flexible in its seafood purchasing and utilization patterns. This flexibility can be developed by becoming familiar with product categories rather than specific products.

This consumer discussion focuses on how achieving the dual goals of product acceptance and affordability can be accomplished. It begins by providing background about:

SUPPLIES OF SEAFOOD

Seafood production is hunting, so major fluctuations in supply are normal. Variations in supply occur because of three distinct types of changes: cyclical, seasonal and random change.

Cyclical variation refers to changes in the composition and size of fish populations. For example, fish harvests which are successively smaller or where the individual fish

¹³Retailing seafood product prices increased 9% in 1986 alone compared to a total price increase of 3% for all other food items during 1982-86. This relatively high rate of change was the result of the combined effects of greater demand, information about the seafood marketing system and explains in detail why consumers need to become more flexible in their seafood purchasing patterns. Next a concept is developed which assists consumers in comparing and evaluating unfamiliar products with traditional favorites.

are fewer in number are indicative of excessive fishing pressure, environmental changes on fish stocks or a combination of a poor year's recruitment coupled with fishing pressure. Cyclical variation occurs over the long run and is gradual. To cope with cyclical variation, a variety of fisheries management measures such as poundage quotas, trip limits, opening / closing of fishing seasons or areas or certain gear restrictions may be implemented. These management strategies will influence the price of the regulated product, in part because management measures designed to conserve fish or exclude certain sizes from capture mean that fewer pounds will enter the marketing channel. As with most goods, when the supply is constricted (for whatever reason) and demand is constant the price will increase and vice versa.

Seasonal variation is indicative of supply changes that occur within a twelve-month interval. A good example of this type of variation is the annual salmon run in the Northwest. Seasonal variation is somewhat predictable and certainly easier to manage than the situations which cyclical variation creates. Seasonality used to mean that at times of the year certain products were unavailable, while during the "run" these varieties were quite abundant. This idea of "feast or famine" has changed, in part because of a more sophisticated harvesting effort, a more updated communications network among dockside buyers and other seafood marketing intermediaries, and better product preservation procedures. Today, seasonality generally implies price fluctuations based on the level of production in the period instead of out of stock situations. When certain fish are scarce, the price paid to harvesters goes up, and when fish are plentiful the ex-vessel price drops. With very little forward contracting done between fishermen and dockside buyers to even out price variations, seasonality implies price fluctuations based on the fishing year for many species.

The third type of variation is random. Random variation is short term in nature and includes production changes based on weather, fish behavior and ocean conditions. Weather is the most significant variable which prevents fishermen from leaving the dock. Winter weather in the northern portion of the country most significantly hinders fish production, but hurricanes etc. also create real obstacles to seafood production. This type of variation usually creates the unavoidable out-of-stock situations for certain species that wholesale and retail interests experience on a week-in, week-out basis.

Since seafoods are generally produced through hunting, luck plays a role in production levels. And since fish are legally categorized as common property resources, they may be subjected to management by regulatory groups for the long term public interest. Therefore, wild caught fish supplies vary more

than their aquacultured counterparts, and the price paid is a result of the supply fluctuation and the demand that exists for the species.

SEAFOOD DEMAND

From an overall industry perspective, demand for individual seafood products has been determined by historic use patterns. Therefore, traditional favorites such as red snapper, grouper, cod, haddock, flounder, shrimp, salmon, and tuna are perpetual good selling products. These varieties are always in great demand, and prices are generally high relative to other seafoods. Prices are high for two reasons. First, because the species in question may have been subjected to the most fishing pressure. Second, many seafood firms have "standing orders" for large quantities of these perennial favorites so when the supply is constricted the price increases.

There is another group of seafood items: the under-used, non-traditional, seldom-seen, or unappreciated varieties. This group of products encompasses everything that does not get classified as "traditional". This product category is comprised of a wide resource base capable of providing meals as delicious as those prepared with the more traditional favorites. Examples of these non-traditional products include certain species of shark, whiting, cusk, hake, pollock, amberjack, black drum and many more. Generally, this category does not experience as intense nationwide demand as do the traditional favorites. While the constant production fluctuations create price variations for both traditional and under-used products, prices usually are lower for seldom-used species because the demand is less intense.

This issue of traditionally-consumed seafoods and seldom-seen varieties has come about because of some traditional industry practices and consumer behavior which reacts to these industry practices. Traditional industry practices include the historic dependence on just a few species to satisfy market demands of American consumers. For years, the New England groundfish fleet has concentrated on three finfish varieties: cod, haddock, and flounder. In the Gulf states, shrimp production is the most valuable fishery, while Alaska, Washington, and Oregon have traditionally produced 90 percent of the wild-caught salmon.

Today, fishermen are faced with higher production costs and are seeking ways to increase profit from each fishing trip. To do this, they are harvesting more varieties of fish and taking better care of landed product. In other words, U.S.

fishermen are attempting to utilize more fully the abundance of products available offshore.

However more complete utilization of fishery resources is stifled by another traditional industry practice: the retail identification system for seafoods. According to current FDA regulations, seafood products must be identified at retail by their customary market name. For most products this means species. Also, the market form is important and in some cases size is required (as with shellfish) to complete the retail identification. Therefore, cod fillets, swordfish steaks, and select oysters typify the retail identification plan for seafoods. Seafood is the only animal protein source that must be identified and sold in this manner. Retail identification for beef is based solely on the location of the cut. Identification of poultry at retail is based on anatomical features such as legs, thighs, backs, etc.

Marketing seafood on a species basis has created an artificial sense of exclusiveness among species. This situation has created real barriers for consumers who are somewhat adventurous and willing to try other seafood products. While species classifications provide biologists with information about how one organism relates to others, species is not a good way to compare the edibility characteristics among products. In-the-round all finfish products are distinguishable by appearance. In the skin-on fillet form there are still some differences that can be discerned, primarily by the skin. However, skin-off fillets of different varieties are difficult to distinguish, particularly those fillets that fall into similar categories. To determine what species a particular skin-off product was cut from requires an involved chemical test. This is the only way to be certain of the species. For example, cod and wolffish have obvious differences in-the-round. But, when skin-off products are evaluated on their edibility profiles, the meat similarities are striking. Similarly, red snapper and sheepshead have surprising edibility similarities.

Consumer research consistently indicates that preparation knowledge continues to be an impediment to greater retail seafood sales and that people are somewhat reluctant to purchase unfamiliar seafood products. This idea of purchase risk is an outgrowth of consumers wanting to get the most value for their dollar. Seafoods are particularly good candidates for risk of purchase because:

- (1) they are fairly high-priced items and the degree of purchase risk is proportional to the cost of the item;

- (2) as edibles, seafoods are experience items which means that the product must be purchased to test the claims made; and
- (3) the variety of seafood products may be very confusing to most consumers.

Purchase risk is a real phenomenon and translates into low levels of demand for all but a few tried-and-proven seafood varieties.

Effective demand for seafoods is influenced by a number of interrelated factors. As discussed, customers' familiarity with the product influences how intensively they will consume it, but concern for staying within budgets may force patrons to purchase lower-priced items in the meat department.

From an industry perspective, one of the best reasons for consumers using traditional and under-used products is the way that changes in price affect consumption of a seafood variety. According to a study of demand determinants conducted at Virginia Tech, the factors most affecting meat and seafood consumption were: changes in prices, changes in income and changes in family size.¹⁴ While price changes are only one factor influencing consumer demand, variation in prices is the norm in the seafood industry. As an example of how price changes affect seafood sales, researchers at Virginia Tech found that a 1 percent price increase will result in more than a 1 percent reduction in demand.¹⁵ Therefore, if the objective is to have consumers incorporate more seafood into their diets, then they must learn how to purchase those products which represent a value relative to other meat department items. Depending on the time of year, etc., marine food products that represent the best value may be "non-traditional" items.

¹⁴Secondary factors include location of residence, the availability of complementary items, and substitute goods (Capps and Havelicek, 1981).

¹⁵While the study was conducted on a national scale using historic data, it is logical to expect demand to decrease because of the price change, since the meat mix at retail contains several substitutable animal protein sources: beef, pork, poultry, and perhaps veal.

A BEGINNING STRATEGY FOR UNDERSTANDING THE SEAFOOD PRODUCT LINE

Superficially it would seem that convincing consumers to use those "better valued" products would be simple since everyone wants to save money on their food bill. However, accomplishing this task has been difficult. While acceptable, many traditionally demanded products are priced beyond many consumers' budget constraints. Conversely, while many under-used products are within the range of consumers' budgets, they are unacceptable simply because they are unfamiliar and therefore do not pass the acceptability test. Quite often, the names and costs of certain finfish varieties differ far more than the taste.

The essence of this strategy is to make affordable products acceptable to the trade area by relating them to those traditional (and acceptable) products. This is done by understanding why people consume a certain species and not another. As an example, why do people eat red snapper? Familiarity is an important factor, but there are other reasons, including flavor, color, texture, etc. Essentially, people eat red snapper because they enjoy its edibility traits, i.e. its light color, firm flesh and mild taste.

Seafood chefs have long known that many finfish varieties are similar in taste. For example, the term "whitefish" is often used as a generic term for cooked white fleshed fish with a very low fat content and delicate-to-bland flavor. Traditional "whitefish" products include flounder, halibut, turbot, ocean perch, cod, and haddock. Less familiar "whitefish" species include grouper, monkfish, cusk, drum, wolf fish or ocean catfish, pollock, tilefish, and shark. Many of these varieties are similar in flavor but their texture varies from firm with large flakes, to soft with a smoother texture.

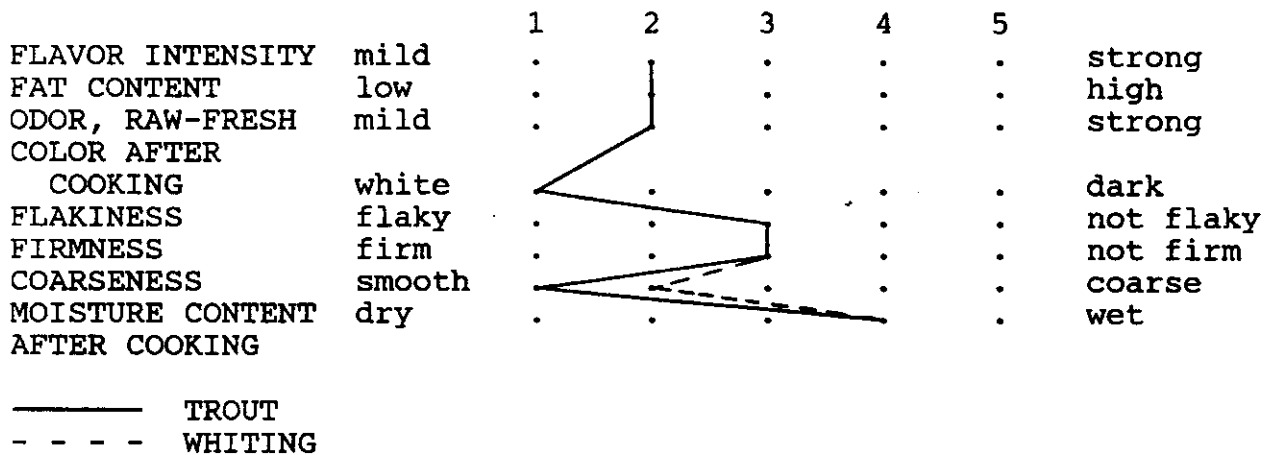
The darker-fleshed varieties also have some similarities in flavor intensity and overall edibility. As an example, the Atlantic bluefish and the Atlantic mackerel are quite similar in their edibility.

EDIBILITY WORK CONDUCTED BY THE NATIONAL MARINE FISHERIES SERVICE (NMFS)

Several years ago, the National Marine Fisheries Service developed a rating scale to describe, objectively, the edibility traits of commercially harvested finfish. In Figure 1 edibility is composed of flesh color, texture, level of moisture, oil content and flavor. Rating a particular species

on the basis of edibility factors resulted in a "fish taste curve." As shown, the edibility profiles for spotted seatrout and whiting are quite similar. Color, moisture, oil content, and flavor components are identical or almost identical in every instance. The most pronounced difference came in the area of texture, with whiting being a bit more coarse than spotted sea trout.

Figure 1
Edibility Profile For Spotted
Sea Trout and Whiting
(form The Brand Group, 1978)



Once a data bank of edibility profiles was developed, the next step in the retail identification process was to develop techniques for categorizing groups of similar-tasting species. From the standpoint of consumer awareness, it was determined that two of the edibility factors, flavor intensity and flakiness, were more important than others. As illustrated in Table 1, categorizing finfish by flavor and flakiness provides an objective description of the edibility traits most important to consumers and assists them in understanding the idea of substitution. The species within each category are quite similar in terms of flavor and flakiness.

This project is still in progress under the supervision of the U. S. Army Quartermaster Corps Food Research Laboratories, Natick, Massachusetts.

Table 1. List of Commercially-produced Finfish
Categorized by Flavor Intensity and Flakiness
(From The Brand Group, 1978)

Common Name	Usual Market Form	Scientific Name
Mild & Flaky		
Atlantic Cod	F ¹ , S ²	<u>Gadus mohura</u>
Cusk	F, PR ³	<u>Brosme brosme</u>
Haddock	F	<u>Melanogrammus</u> <u>aeglefinus</u>
Ocean Whitefish	F, S	<u>Caulolatilus princeps</u>
Pacific Halibut	S	<u>Hippoglossus</u> <u>stenolepis</u>
Mild & Moderately Flaky		
Alaska Pollock	F	<u>Theragra chalcogramma</u>
Southern Flounder	F	<u>Paralichthys</u> <u>lethostigma</u>
Rainbow Trout	PR	<u>Salmo gairdneri</u>
Brook Trout	PR	<u>Salvelinus fontinalis</u>
Lake Whitefish	F, S	<u>Coregonus clupeaformis</u>
Mild & Average Flakiness		
Yellowtail Flounder	F	<u>Limanda ferruginea</u>
Petrale Sole/Brill	F	<u>Eopsetta jordani</u>
Rex Sole	F	<u>Glyptocephalus</u> <u>zachirus</u>
Summer Flounder/Fluke	F	<u>Paralichthys dentatus</u>
Dover Sole	F	<u>Microstomus pacificus</u>
Rainbow Smelt	PR	<u>Osmerus mordax</u>
Pacific Sanddab	PR	<u>Citharichthys sordidus</u>
Moderately Mild & Flaky		
Red Snapper	F	<u>Lutjanus campechanus</u>
Atlantic Halibut	S	<u>Hippoglossus</u> <u>hippoglossus</u>
Spotted Grouper	F	<u>Epinephelus itajara</u>
Yellowfin Tuna	S	<u>Thunnus albacares</u>
Black Sea Bass	F	<u>Centropristis striata</u>
Sheepshead	F	<u>Archosargus</u> <u>probatocephalus</u>

Common Name _____ Usual Market Form _____ Scientific Name

**Moderately Mild
& Moderately Flaky**

Winter (Blackback) Flounder	F	<u>Pseudopleuronectes americanus</u>
Lingcod	F, S	<u>Ophiodon elongatus</u>
Sand/Ground Shark	F, S	<u>Odontaspis taurus</u>
Striped Bass	F	<u>Morone saxatilis</u>
American Plaice	F	<u>Hippoglossoides platessoides</u>
Turbot	F	<u>Psetta maxima</u>
Florida Pompano	F	<u>Trachinotus carolinus</u>
Atlantic Croaker	PR	<u>Micropogon undulatus</u>

**Moderately Mild &
Average Flakiness**

Ocean Pout	F	<u>Macrozoarces americanus</u>
Arrowtooth Flounder	F	<u>Atheresthes stomias</u>
Spotted Seatrout	F, PR	<u>Cynoscion nebulosus</u>
Silver Hake	PR	<u>Merluccius bilinearis</u>
Pacific Pollock	F	<u>Pollachius virens</u>
Red Hake	PR	<u>Urophycis chuss</u>
Spot	PR	<u>Leiostomus xanthurus</u>
Greenland Turbot	F	<u>Reinhardtius hippoglossoides</u>

**Moderately Mild &
Slightly Flaky**

Butterfish	PR	<u>Porontus triacanthus</u>
------------	----	-----------------------------

**Moderately Mild
& Not Flaky**

Spiny Dogfish	F	<u>Squalus acanthias</u>
---------------	---	--------------------------

**Average Flavor
& Flaky**

Atlantic Pollock	F	<u>Pollachius pollachius</u>
Rockfish	F	<u>Sebastes spp.</u>
Swordfish	S	<u>Xiphias gladius</u>
Black Drum	F	<u>Pogonias cromis</u>
Sockeye Salmon	F, S	<u>Oncorhynchus nerka</u>

Common Name _____ Usual Market Form _____ Scientific Name _____

**Average Flavor
& Moderately Flaky**

Common Dolphin	F	<u>Coryphaena hippurus</u>
Ocean Perch	F	<u>Sebastes marinus</u>
Scup/Porgy	PR	<u>Stenotomus chrysops</u>

**Average Flavor
& Slightly Flaky**

White or Sand Seatrout	PR	<u>Cynoscion arenarius</u>
------------------------	----	----------------------------

**Average Flavor
& Not Flaky**

Monkfish	F	<u>Lophius americanus</u>
----------	---	---------------------------

**Moderately Strong
& Moderately Flaky**

King Mackerel/Kingfish	S, F	<u>Scomberomorus cavalla</u>
Atlantic Mackerel	F	<u>Scomber scombrus</u>

**Moderately Strong
& Slightly Flaky**

Spanish/Spotted Mackerel	PR, F	<u>Scomberomorus maculatus</u>
--------------------------	-------	--------------------------------

**Strong &
Average Flakiness**

Bluefish	F, S, PR	<u>Pomatomus saltatrix</u>
----------	----------	----------------------------

-
- 1 Fillets
 - 2 Steaks
 - 3 Pan-ready (dressed or drawn)

Notice that in the category "Moderately Mild and Flaky", red snapper, long the prize of Gulf waters, has many of the same characteristics as the humble Sheepshead. In the Texas market red snapper retails for about \$4.50 per pound while sheepshead is priced about \$2.00 - \$2.25 per pound.

The category labeled "Moderately Mild with Average Flakiness" contains some interesting species. The silver hake, or whiting is a traditional favorite in the Northeast, appearing off the coast of Long Island in late October. Whiting are usually sold pan ready, with a retail price of about \$2. The whiting fishery lasts until March, and for the winter months represents a good value to shoppers. Spring and summer is the season for sea trout. The size of the trout varies from 1 to 10 pounds. The typical market form for the smaller animals is pan ready, and the price per pound is roughly \$2.00. Therefore, for those trade areas which prefer a lower priced fish, the trout/whiting combination can be perpetually carried, dramatically reducing the effect of seasonality.

Other Edibility Ideas

Another suggested technique is to categorize finfish based on similarities in the normal market form, thickness of the form, and flavor, so that cooking techniques would match the product's characteristics. From a retailers' standpoint, this is a very good technique because it is easily understood by consumers. This technique specifies four groupings of finfish:

- Group 1: Thin, delicate product
- Group 2: Medium dense, light-colored varieties
- Group 3: Medium dense, darker-colored meat
- Group 4: Thick and dense-fleshed products

This categorization technique is not as objective as the concept developed by the National Marine Fisheries Service. However, from an operations and consumer standpoint, the minor differences among species can be overlooked. The trade-off between a system such as the National Marine Fisheries Service's idea and the one just outlined is that the NMFS project, while much more accurate at describing a species' edibility profile, is more difficult to communicate to consumers. On the other hand, the categorization which breaks seafoods into four groups can be easily understood, and the thought of grouping products to make the cooking method the first decision is consistent with other items in the meat mix. For example, a thick fillet of gray seatrout would probably be prepared differently than a small pan-ready whiting, even though the two species are practically indistinguishable in taste.

Products falling into Group 1 include fillets of sole, flounder, some turbot, and pacific sand dab. These varieties are all very delicate. Once cooked, they tend to fall apart if handled. A saute or a bake are the best cooking techniques for these varieties. When wrapped around a stuffing mixture, these flatfish products also make a very elegant meal.

The product line in Group 2 is much more extensive. These varieties are firmer than the previous group, and the fillets are generally thicker. Within this category there are several species which are generally marketed as headed-and-gutted, or pan-ready. Small speckled seatrout, scup or porgy, whiting or silver hake, croaker, and catfish are often sold as pan-ready products. Fillets within Group 2 include cod, haddock, pollock, cusk, rockfish, ocean perch, corvina, gray seatrout, sheepshead, catfish, tilefish, monkfish, red snapper, black drum, and spiny dogfish. Salmon is generally steaked, but more outlets are finding good product movement with salmon fillets. Despite their thickness, most products in this category are flaky. Even the spiny dogfish (a small shark) which is not too flaky can be flaked into a delicious cold salad. The best cooking techniques for these varieties are baking, poaching or frying. Some of the products in this category have a higher oil content and they baste themselves while baking. The leaner varieties such as pollock, cod and drum generally need some adornment with dry heat cooking to insure a moist product.

The medium-dense, darker-colored fish in Group 3 include tuna, mackerel, black cod or sablefish, mullet, king mackerel, salmon, and bluefish. These fish are oily and are very good smoked. Poaching and baking are good indoor cooking techniques, but frying these varieties often makes them too rich in oil.

Group 4 consists of the large, meaty, extremely dense fish. Examples of these fish include swordfish, shark, grouper, Atlantic and Pacific halibut, and sturgeon. These products are generally sold as steaks, some with the bones removed. Their dense, meaty character makes them ideal for grilling, making kabobs, or barbecuing. Poaching is also a good cooking technique for these varieties.

The strength of this categorization is that within each group there are similar-tasting but different-priced products. This provides the shopper with the ability to seek products which bear some similarities to familiar ones but sell for less. In Group 1, the most expensive product is genuine dover sole, while the least expensive is turbot (which may not be true turbot after all). Haddock, catfish, Pacific rockfish, cusk, and sheepshead represent a group of light, flaky, bland fish which spans a wide price range. As another example, a large shark steak generally retails for about 1/3 the cost of a

similar-sized refrigerated swordfish steak.

Helping the consumer understand the similarities among products is a positive step to greater consumption of seafoods in the home. Using this idea of substitutability will require additional time to understand species similarity. Is this technique worth the extra time required?

Several typical supply-side interruptions can be managed by using the substitutability concept. For instance, when consumers' palates are adjusted to a particular item which goes out of season, a similar tasting product can be substituted, like trout and whiting.

As another example, swordfish, long a prized food fish, has many of the same edibility characteristics as shark: light colored meat, bland flavor and a firm texture. Swordfish often retails for about \$7.50 a pound, while shark will be selling for \$3 - \$4. Because so many species have similar edibility traits, seafood varieties can be substituted without sacrificing the more important edibility characteristics of traditional, acceptable favorites.

INSURING SUCCESS

The essence of understanding seafood product categories is to factor out as many of the artificial differences among finfish species as possible. These "contrived" differences baffle the customer and, in fact, may intensify their sense of purchase risk. Imagine how intimidating a thirty five-item seafood mix can be when the shopper may be familiar with only six items. Imagine how difficult it is for the infrequent seafood user to make a purchase decision strictly by species name alone.

The first and most difficult "difference" which can be factored out is taste similarities among species. Table 1 illustrates that a number of seafood varieties have similar edibility traits. Favorite varieties which are either unavailable or priced beyond comparable alternatives represent a lost sale. By systematically selecting similar tasting varieties that are available and competitively priced, consumers can enjoy seafoods more frequently; and seafoods can become a versatile food, easily dressed up for special occasions or prepared simply for a quick, nutritious meal during the week.

The next variable to consider is market form. The comparison of similar market forms will facilitate choosing alternative species that have similar tastes and can be prepared in the same manner.

There is one more variable, cost, that has to be considered. Consumers can make intelligent decisions about cost when the differences in taste and market form are alleviated. Returning to the example of red snapper and sheepshead fillets, when customers understand that they can cook basically the same entree with either species, then their individual budgets help make the purchase decision. Conversely, if shoppers are not aware of the taste similarities, then familiarity will be more important than price.

BIBLIOGRAPHY

The Brand Group, Inc., 1978. A retail Identification Plan For Seafood Species: A Description of the Product and Recommended Principles of Identification. Chicago.

Capps, O. and J. Havelicek, Jr., 1981. Meat and Seafood Demand Patterns: A Comparison of the S-Branch Demand System and the Constant Elasticity of Demand System. Virginia Agricultural Experiment Station, Virginia Tech, Blacksburg, VA.

Krueckeberg, Harry F. & J. R. Hamilton. Consumer Perspectives of National, Generic and Private Brand Grocery Products. J of Food Dist. Res. (Fed. 1981) 2:1, pp 105-113.

APPENDIX II

THE SEAFOOD DEPARTMENT MANAGER SUPERVISOR AND EVALUATION

It is the department manager's job to manage his department so as to meet the goals and standards set by (or preferable with) higher level management. To do this, however, it is necessary that these goals and standards be clearly defined, well understood by both the department and higher level management, and attainable. In addition, higher level management must be willing to do its part by furnishing the department manager the resources (labor, equipment, space, operating capital, etc.) needed to meet the goals and standards. One way to clarify and formalize mutual understanding and agreement is through Job Performance Analysis.

The Job Performance Analysis

Job performance analysis, as the title suggests, it is a way to define what the manager is expected to do, (the goals and standards). However, there is more to it than that. It also defines the resources needed to do the job and then by what means the manager will be evaluated. As you start a job performance analysis, the form looks like this:

Figure I
Job Performance Analysis

Job Seafood Department Manager
Person - Albert Pearson, Store 92¹

Duties, Goals or Standards	Resources Needed	Evaluation Method
----------------------------	------------------	-------------------

Let's look at the parts of this form more closely.

Duties, Goals or Standards: As you decide upon the duties, goals, or standards for the manager, there are at least 6 criteria to keep in mind. These are:

- 1) They should be limited in number. Ten to twelve probably should be the maximum number.

- 2) They should be representative of the total job. You can look at them and evaluate overall performance.
- 3) They should be interdependent--a manager cannot concentrate in one area at the expense of another (eg. if he keeps labor very low, customer complaints or spoilage due to poor handling may increase).
- 4) They should, whenever possible, be measurable dollars, pounds, percents, etc.
- 5) They should be realistic and attainable--In most stores a goal that seafood sales should be at least 2% of total store sales probably would be realistic and attainable; 10% probably would not.²
- 6) They should be at least partially controllable by the seafood department manager (eg. usually the department manager has little control over advertising and promotion so results of such activities should reflect upon the merchandiser rather than the department manager).

Using these criteria, some possible duties, goals, or standards for a seafood department manager are shown in figure II.

¹ Each seafood department manager will have different job performance Ref. analysis since duties, etc. will differ among stores.

² A goal of perfection, eg. 100% in stock, 0 customer complaints, etc. is virtually unattainable so seldom if ever make such a goal.

Figure II.
Job Performance Analysis

Job - Seafood Department Manager
Person - Albert Pearson, Store 91

- 1 - Sales equal 2.6% of total store sales
- 2 - Net margin equal 3.77 of store net margin
- 3 - Ninety percent of received merchandise is sold at posted prices
- 4 - Maintain 23% gross margin
- 5 - Under 5% out of stock
- 6 - Not more than 8% total shrinkage
- 7 - Between \$65 and \$75 sales per department man hour
- 8 - Under 3% pricing errors
- 9 - Under 5 customer complaints per week to store manager
- 10 - Case fully dressed by 10:00am each day
- 11 - Not more than 1 deficiency per health department inspection
- 12 - Reports on time over 95% of the time

Resource Needed for Success: Now, upper level management must furnish the manager enough resources that, if he manages them efficiently, he can meet these duties, goals, and standards. Each duty, goal, or standard has one or more kinds of resource needed, although in some cases, the resource is shared with other duties. Once these resources are identified and listed on the form, the Job Performance Analysis may look as follows:

Fig. III Job Performance Analysis

Job
Person

Duties, Goals, or Standards

Resources Needed

1. Sales equal to 2.6% of total store sales

1. Sufficient backroom, cooler, & display space to accommodate these sales
2. Authority to purchase sufficient merchandise to meet these sales

2. Net Margin equal to 3.7% of store net margin

1. Authority to order mix to attain desired profit margin
2. Authority to lower prices on "distress" or overstocked merchandise

3. Ninety % of received merchandise sold at posted prices

1. Authority to order merchandise quantity and mix to stay within guideline
2. Holding area sufficient to store 0-10% of inventory
3. Authority to reject substandard deliveries

4. Maintain 23% gross margin

1. Authority to adjust display space and methods to influence sales among different margin and volume items
2. Within prescribed limits select items to be carried in the department

5. Under 5% out of stocks

1. Authority to order sufficiently for desired sales

6. Under 8% total shrink

1. Sufficient storage and display space for desired volume
2. Authority to work down overstocks
3. Develop, institute, and enforce quality maintenance program

- | | |
|--|--|
| 7. Between \$65 and \$75 sales per department man hour | <ol style="list-style-type: none"> 1. Allocate man hours of labor to achieve \$65-\$75 sales 2. Authority to hire additional labor if department sales go beyond above figure 3. Allocate 1-2 hours/week/employee for employees training (in store or out) 4. Authority to evaluate discipline, and reward employees for performance |
| 8. Under 3% pricing errors | <ol style="list-style-type: none"> 1. Timely and complete price list available weekly |
| 9. Under 5 customer complaints per week to store manager | <ol style="list-style-type: none"> 1. Company policy regarding customer complaints 2. Authority to deal with each complaint within company policy |
| 10. Case fully dressed by 10 A.M. each day | <ol style="list-style-type: none"> 1. Authority to schedule amount and timing of labor |
| 11. Not more than 1 deficiency per health dept. inspection | <ol style="list-style-type: none"> 1. Company policy and operating manual re quality maintenance 2. Authority to correct any observed or reported deficiency immediately 3. Authority to correct or discipline any employee violating policies or procedures |
| 12. Reports on time over 90% of the time | <ol style="list-style-type: none"> 1. Training on report preparation 2. 4 hours/week allocated to report preparation |

Evaluation Methods

Employees, including management, want to know what is expected of them -- the duties, goals, and standards outlined above tells the seafood department manager this. Employees, including management, want to know what resources and authorities they have to accomplish these -- the resources column above describes them. In addition, employees, including management, want to know by what means their bosses will be checking up on them. The third column of the job performance analysis tells them this. Again, each duty, goal, or standard has its own formal or informal evaluation tool(s).

Fig IV Job Performance Analysis

<u>Job</u>	<u>Person</u>	
1	1	1- store reports
	2	
2	1	1- store reports
	2	
3	1	1- department sales records
	2	
	3	
4	1	1- store records
	2	
5	1	1- reorders 2- spot checks by merchandiser and store manager
6	1	1- order, inventory, and sales records
	2	
	3	
7	1	1- sales records
	2	2- labor records
	3	
	4	
8	1	1- spot check by merchandiser and store manager
9	1	1- quiz re company policies
	2	2- number of complaints reported
10	1	1- spot checks by merchandiser and store manager
11	1	1- quiz re company policies
	2	2- spot inspections by personnel headquarters
	3	3- official reports by Health Inspectors
12	1	1- evaluation of reports
	2	

Summary

Job performance analysis is a very useful management tool. Well thought out and then used well, it becomes a key element of supervision. It does not, however, replace human judgment. It simply assists humans make better management decisions. It is only as good as the thinking that goes into developing it and the thinking that makes use of it.

APPENDIX III

DEFINITIONS FOR THE MARGIN MANAGEMENT SPREADSHEET

1. Seafood Species - Seafood specified by name
2. Unit Measure - Defined unit, quantity/species
3. Units Bought - Volume of product procured
4. Cost of Goods - Price paid times unit for species
5. Shrinkage - Product loss after purchase and prior to sale
6. Retail Price - Customer price
7. Units sold - Quantity, adjusted for shrinkage values/specie
8. Price of Goods Sold - Retail price times quantity, adjusted for shrinkage
9. Gross Margins Dollars with Shrinkage - Revenues remaining after costs of goods, adjusted for shrinkage
10. Gross Margins Dollars without Shrinkage - Revenues remaining after costs of goods
11. Gross Margins Percentage with Shrinkage - $\frac{\text{Price} - \text{Costs}}{\text{Price}}$ adjusted for shrinkage
12. Gross Margins Percentage without Shrinkage - $\frac{\text{Price} - \text{Costs}}{\text{Price}}$
13. Totals = Results from the spreadsheet calculations

Example of Fish Species (list not complete)

(*) Fish Selections - Croaker, Bluefish, Spot, Tuna, Crabmeat, American Shad

(**) Fish Selections - Mackerel, Oysters (meats and shellstock), Scup, Whiting

Fish Selections (All Seasons) - Sea Bass, Clams, Scallops, Monk, Flounder, Sea Trout

(*) Summer, (**) Winter

APPENDIX IV

PERISHABILITY OF SEAFOODS

Factors which affect quality are many and varied. They may include: species, area of catch, method of catch, handling on board the fishing vessel, and processing techniques. These are factors over which you, as seafood merchandisers, have no control. Our purpose, in this discussion, will be to look at factors over which you do exercise control.

The spoilage of fish can be related to a complex process of interrelated factors. As soon as fish die, a whole series of changes begin in the flesh related to:

1. Bacterial growth
2. Enzymes
3. Oxidation
4. Dehydration

BACTERIAL GROWTH

Loss of quality due to bacterial action is probably the most well known to consumers, and has the most obnoxious effects.

Bacteria are found on live fish in the surface slime, intestines, and gills. Once the fish dies, it loses its defenses against those bacteria which are capable of decomposing tissues. Therefore, what follows is a breakdown of the tissues by enzymes released by bacteria thus producing what is characteristically seen as spoilage.

Many seafood merchandisers do not handle whole fish, instead they may handle dressed fish, steaks, or fillets. With these three market forms, the naturally present source of bacteria are absent. Be assured, however, that bacteria are present in significant numbers on the surface of these products as a result of contamination during processing and handling.

Factors that affect the rate of bacteria spoilage:

- A. Initial Number of Bacteria
- B. Temperature of Product
- C. Types of Bacteria

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

<u>Temperature °F</u>	<u>Approximate shelf-life (days)</u>
32	14
34	11
37	8
39	7
41	6
44	5
45	4
56	3

Table 2. Shelf-life of various processed and unprocessed fish
vs. temperature of storage (Keay and Hardy, 1978)

Type of Fish	<u>Storage Temperature</u>		
	<u>50°F-68°F</u>	<u>32°F-36°F</u>	<u>-22°F</u>
Ungutted small fatty fish, e.g. sprats and herring	1 day	5-7 days	9 months to 2 years
Ungutted small white fish, e.g. blue whiting, argentines	1 day	5-7 days	2 years
Gutted fatty fish, e.g. herring, mackerel	1 day	7-10 days	9 months to 2 years
Gutted white fish, e.g. cod, haddock	1 day	10-16 days	2 years +

A question that is often asked is **why are fish so perishable?** A partial answer is that marine fish (saltwater fish) have within their tissues small molecular weight nitrogenous compounds referred to as osmoregulators. These osmoregulators function, in the live animal, to counter the osmotic pressure created by the salt concentration in ocean water. Most of you have eaten a marine fish at one time or another and found that the meat did not taste salty; in fact, doctors often recommend seafoods to individuals on low sodium diets. If these osmoregulators were not present, salts from the ocean environment would readily

diffuse into the animal's tissues and, assuming the animal could live, the meat from the fish would be salty.

What do osmoregulators have to do with perishability? The best analogy is that bacteria are a lot like people; that is bacteria tend to do what is easiest first. On foods lacking these low molecular-weight osmoregulators, bacteria must first break down large protein molecules into smaller units before they can use the protein as food. Consequently, it takes time before these proteins are degraded, and during this period, there is not a large pool of readily usable food to support rapid growth. On the other hand, marine fish with these osmoregulators already present provide an immediately usable food source for bacteria which allows them to multiply rapidly, therefore, contributing to perishability. As might be expected, freshwater fish generally maintain quality somewhat longer than saltwater fish.

Tropical vs. Cold Water Species

Occasionally, you may have an opportunity to merchandise tropical or subtropical species from areas such as the Gulf of Mexico; therefore, it may be important to know iced shelf-life differences between tropical fish and temperate or cold water species. Contrary to what you might think, fish caught in warm tropical waters and iced have a longer shelf-life than fish caught in temperate or cold water. One study compared the acceptable shelf-life of 10 coldwater species with 12 tropical species. The cold water fish remained acceptable for 5 to 15 days depending upon the species but the tropical fish kept for 7 to 45 days. This extended shelf-life is thought to be related primarily to the temperature tolerance of the bacterial flora of tropical fish. The mesophilic bacteria (bacteria that grow at temperatures between 68°F to 113°F but have an optimum growth at 86°F to 104°F) are adapted to high ambient temperatures and the large drop in temperature has a more pronounced effect. This effect is reflected in the lower level of total viable bacterial counts reported for tropical fish.

ENZYMES

Chemical changes in the tissues of dead fish may contribute significantly to product deterioration. The chemical changes are brought about by enzymes which are naturally present in fish and remain active after the death of the animal. When a fish dies, it loses its defenses against its own enzymes. These enzymes (the digestive enzymes of the stomach and intestines and autolytic enzymes of the tissues) may be active even at sub-freezing temperatures, although the activity is greatly reduced.

An example of enzymatic deterioration may be seen in

improperly preserved whole fish, particularly fish which had been feeding just prior to capture. When whole fish are not properly handled, the active digestive enzymes actually break down the tissues of the digestive tract and start digesting the edible body tissues. This phenomenon is often referred to as belly burn.

As you would expect, it's possible to have spoilage in a completely sterile fish (bacteria free) due to the breakdown of muscle tissue by these endogenous enzymes. However, from a more practical perspective, the softening of tissues and flavor changes caused by natural enzymes are most apparent during the first few days of iced storage before bacterial spoilage has supervened. Just as osmoregulators encourage early microbial growth, enzymes break down protein which can then be used directly by bacteria for food.

OXIDATIVE CHANGES

How many of you have ever tasted rancid fat? The bad taste and aroma experienced is caused by oxidative rancidity, which results from the reaction of oxygen (from the atmosphere) with unsaturated oils composed of fatty acids. This reaction produces a variety of end products which result in the disagreeable odors and flavors. One of the unfortunate aspects of this problem is that these unsaturated fats are what make seafoods so attractive to many individuals who wish to limit their saturated fat intake; however, if unsaturated fats are not properly handled, they will cause rancidity.

There are tremendous variations in the fat content of various fish species. Even with a single fish itself, some portions undergo rancidity more readily than other parts. Seasonal variations in susceptibility to rancidity have also been demonstrated.

Fish can become rancid even at sub-freezing temperatures unless adequate precautions are taken to prevent oxygen from coming in contact with the product, for instance by use of an appropriate packaging material.

DEHYDRATION

Everyone is aware of the problem of dehydration of frozen meat or seafood products. When a product has been severely dehydrated, it alters the appearance, texture, and flavor of the product. The problem seems to have become more acute in recent years with the advent of frost free refrigerators. The problem is, however, preventable with proper attention given to the product prior to freezing.

KEY FACTORS AFFECTING SHELF-LIFE

Initial Product Quality

When you, as a retailer, purchase a product, it is for all intents and purposes of the highest quality it will ever attain. If the product you purchase is of poor or marginal quality, it at best, will have a very limited shelf-life.

Time-Temperature Relationship

As we have mentioned earlier, unless the product is frozen, the number of bacteria on seafoods will increase, but the rate of increase will be slowed as the temperature is reduced. Thus a product at 32°F may keep twice as long as a product at 40°F.

Bacterial numbers can increase astronomically within a few hours. Depending on the type of bacteria, some organisms under optimum conditions double their numbers every 10 to 20 minutes. Fresh-caught fish and crustaceans typically carry populations of 100 to 1,000 bacteria per square centimeter of skin surface or per gram of gill tissue (1 square inch equals about 2.54 square centimeters). If we assume that we have 500 bacteria per square centimeter and the product is mishandled due to neglect for 4 hours, and the bacteria double every 15 minutes, how many bacteria are now present on the square centimeter? (32,768,000). A simple rule to remember is -- if you can't keep the product cold, you can't keep the product.

Contamination

You realize that we were probably being very presumptuous in assuming that only 500 bacteria per square centimeter were initially present in the calculation we just made. Earlier we mentioned that between 100 to 1,000 bacteria per square centimeter occurs on freshly caught fish. Thus we were basically assuming no contamination of the product from the time it was caught until you received it. This is not a good assumption.

Contamination can result from many sources, from the very obvious such as a sneeze or cough, to the subtle such as unseen dust being blown about. Contamination can occur from water, soiled clothing, unwashed hands or utensils, and many other sources. Regardless of the source of contamination, the point is that 500 bacteria per square centimeter can become 5,000 or more with just the touch of an unwashed hand or dirty knife.

Cross-Contamination

When speaking of cross-contamination and foods, one generally is referring to the contamination of one food product with bacteria which originated from another food source. The means of contamination could be direct such as two products coming into contact or indirect as in the case of using inadequately cleaned and sanitized equipment to process two or more different products.

Cross-contamination also refers to the direct or indirect contamination of cooked product from raw products. All too often ready-to-eat products are stored and/or displayed next to raw product forms. This is not an ideal situation from a public health point of view. It is not too difficult to imagine situations which could cross-contaminate cooked product with raw product. If you feel you must merchandise cooked products in the same case with raw products, be sure the two are separated by a full-length, plastic partition. Also, it would be wise to merchandise cooked products (such as cooked crabs) behind fresh product. Thus, when customers pick the cooked crabs up they must carry them over the raw products. The reverse situation, whereby the raw product is carried over the cooked, is a potentially dangerous situation.

PROCUREMENT PRACTICES

Know Your Distributor

It is extremely important for the seafood manager to have a good working relationship with the wholesale seafood distributor. The distributor must know of your commitment to market a quality product and he must be an actively participating partner in this effort. One sure way of showing your commitment to quality is by rejecting incoming product which is of poor or marginal quality.

Check Incoming Product for Quality

Many stores rely solely on the distributor to deliver **Quality Product**. In other words, often no one at the store level is responsible for inspecting the product for quality. Admittedly, it is extremely important to deal with a reputable supplier; however, it is equally important for each store to inspect incoming product against universally known and accepted quality standards.

Market Forms

When processing seafoods, particularly finfish, a variety of market forms may be available; therefore, what you purchase depends on the amount of variety and convenience you feel your particular operation should provide.

Whole: Fish as they come from the water. Before cooking the fish must be scaled and eviscerated -- usually the head, tail, and fins are removed. The fish may then be cooked, filleted, or cut into steaks or chunks. From a retailing viewpoint, whole fish may be sold as such, or they may be custom processed at a service counter.

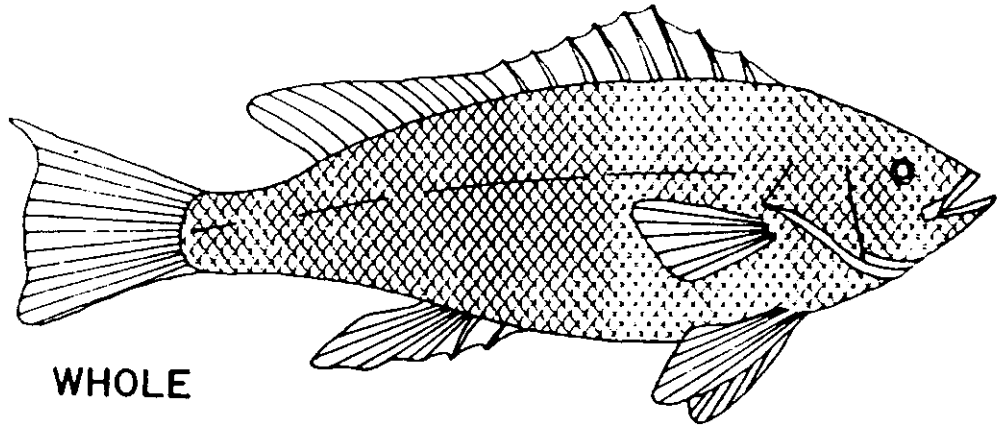
Drawn: Whole fish with entrails removed, with or without scales. Usually the head, tail and fins are intact.

Dressed: Fish with scales and entrails removed, usually the head, tail, and fins are also removed. The fish may then be cooked, filleted, or cut into steaks or chunks. Small dressed fish are often called pan-dressed and are ready to cook as purchased.

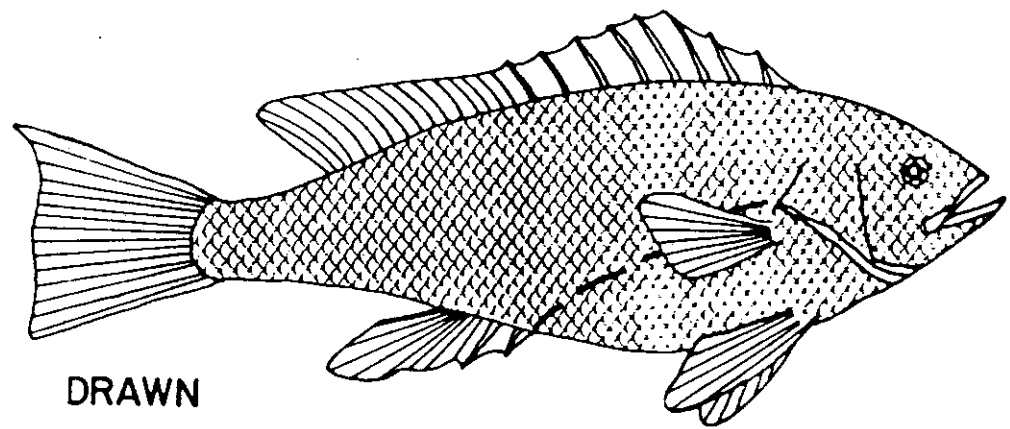
Fillet: Fillets are the sides of fish cut length-wise away from the backbone. They are ready to cook as purchased. A fillet cut from one side of a fish is called a single fillet and is the type most generally available on the market. The fillets may or may not include the skin.

The two sides of the fish cut length-wise away from the backbone and held together by the uncut flesh and skin of the belly are called butterfly fillets.

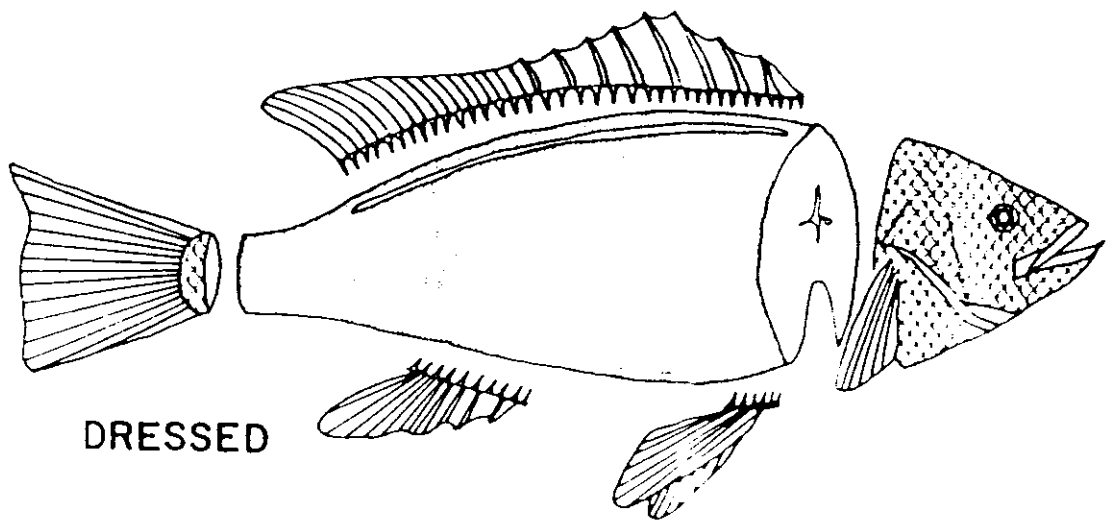
Steaks: Steaks are cross section slices from large dressed fish cut 5/8 to one inch thick. Steaks contain a cross-section of the backbone and sometimes rib and fin bones. They are ready to cook when purchased.



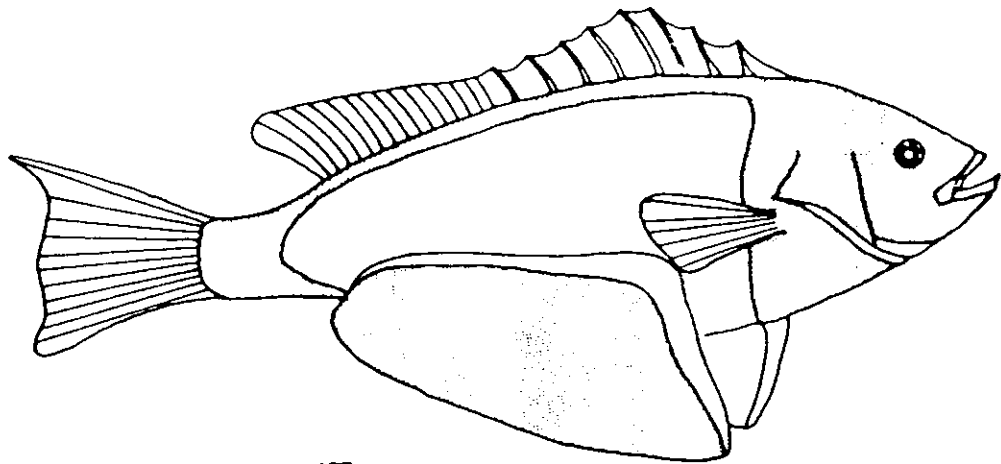
WHOLE



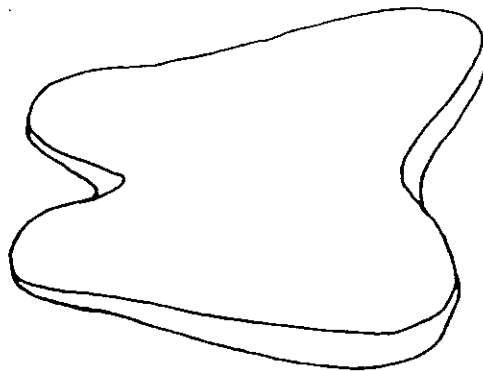
DRAWN



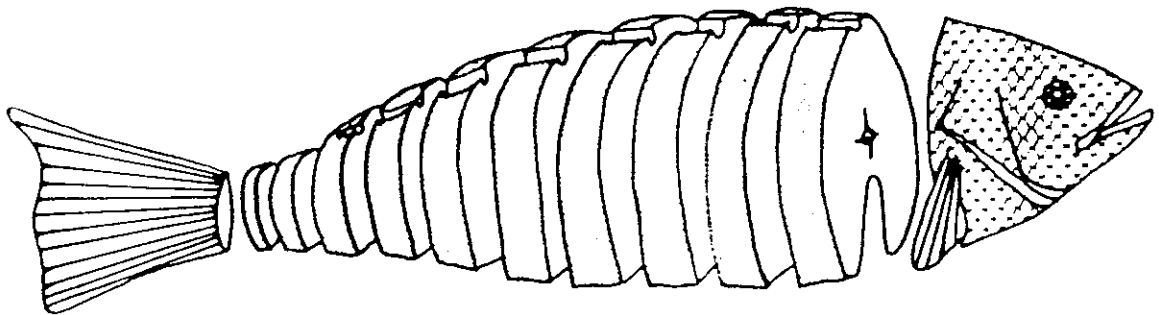
DRESSED



SINGLE FILLET



BUTTERFLY FILLET



STEAKS and CHUNKS

SETTING UP AND MAINTAINING ON-SITE RECORDS

Useful record keeping is beneficial, however, record keeping merely for the sake of record keeping is not necessary and is not what is intended. Suggested elements to include on a product record sheet:

1. Temperature of Product on Arrival

This is an extremely valuable piece of information to have; furthermore, if the temperature is in excess of 40°F you may consider this a basis for rejection of the shipment.

2. Condition of Product on Arrival

For whole fish, you may wish to check the various quality parameters discussed earlier. These parameters were: general appearance, eyes, gills, odor, consistency of flesh, belly cavity, and vent.

For fillets and steaks, the list may include: odor, consistency of flesh, and color.

3. Product Code

First-in-first-out is the rule for any fresh food item; however, unless you have a system established to assist you in keeping track of incoming product, from the time it enters the store until it is sold, you run the risk of handling product longer than is desirable.

Many people may ask why should I go to the trouble of recording the temperature and condition of incoming product? The answer to this might be considered in two parts:

A. If the temperature is higher than 40°F, you have no way of knowing how long this condition has persisted, perhaps two hours or maybe two days. If the temperature has been above 40°F for only two hours, then you may not have a problem; but, if the temperature has been elevated for two days, then the product may be rendered unacceptable before it is sold.

B. The phrase **experience is the best teacher** is certainly true for merchandisers of fresh seafoods. By documenting the condition of the incoming product, you may be able to relate customer satisfaction and possibly shelf-life expectation with initial product quality. This experience may help you initiate or revise internal quality standards for raw product.

A possible form for documenting the condition of deliveries is shown on the following page.

Date _____

Product _____

Amount Ordered _____

Amount Received _____

Distributor of Product _____

Temperature of Product _____

Condition of Containers _____

A. Whole Fish

Appearance _____

Eyes _____

Gills

a. Color _____

b. Odor _____

Odor _____

Consistency of Flesh _____

Belly Cavity _____

Vent _____

B. Fillets or Steaks

Odor _____

Consistency _____

Color _____

C. Shellfish

1. Clams and Oysters

Number of Live Animals out of random sample of 20 _____

2. Lobsters and Crabs

Number of Live Animals out of random sample of 20 _____

D. Shucked Clams and Oysters

Color of Liquor _____

Odor _____

REFERENCES

Keay, J.N. and Hardy, R. 1978. Fish as food. *Process Biochemistry* 13:2.

Ronsivelli, L.J., Gorga, C., Kaylor, J.D., and Carver, J.H. 1978. A Concept for Assuring the Quality of Seafoods to Consumers. *Marine Fish. Review* 40:(1). 1.

APPENDIX V

SANITATION

Sanitation is composed of two separate and distinct operations which are traditionally grouped under the heading sanitation. The two operations are: cleaning and sanitizing.

According to Gellespie and Schwartz (Seafood Retailing, 1977), to sanitize means the adequate bactericidal treatment of cleaned surfaces by a process that is effective in destroying bacteria. Notice the two word phrase **cleaned surfaces**, that is important since many bactericidal agents are ineffective in the presence of grease, soil, or food debris. An effective sanitation program is about 95 percent soap and water applied with liberal amounts of elbow grease. Generally, the function of cleaning compounds is to lower the surface tension of water so that soils can be lifted and flushed away. Cleaning compounds are not intended to kill microorganisms; sanitizing agents have that function. However, large numbers of microorganisms may be removed during the cleaning operation when lifted soils are properly flushed away. After cleaning the surface, sanitizing agents are used to destroy remaining organisms that are exposed as a result of cleaning.

There are two types of cleaning and sanitizing procedures:

<u>STANDARD PROCEDURE</u>	<u>ONE-STEP CLEANING-SANITIZING PROCEDURE</u>
1. Rough clean (broom brush, etc)	1. Rough clean
2. Detergent cleaning	2. Germicidal detergent cleaning and sanitizing
3. Rinse	3. Rinse (if needed)
4. Sanitize	4. Air dry
5. Rinse (if needed)	
6. Air dry	

The supporters of the Standard Procedure say that the cleaning and sanitizing steps must be separated for maximum effect in the reduction of bacterial levels, hence there is no acceptable shortcut to good sanitizing.

The supporters of the One-step Cleaning-Sanitizing Method claim that the new modern germicidal detergents combine the operations with equal effectiveness in destroying bacteria and

also save up to 50 percent in labor.

Whichever method you prefer, either will do the job effectively if combined with correct procedures for cleaning and sanitizing. Both are approved!

SANITIZING AGENTS

There are three basic groups of sanitizing agents used in food processing plants and supermarkets. Whichever one you use is, of course, up to you; however, listed below are some of the advantages and disadvantages of equipment and the temperature of the environment.

Raw Product Equipment and Areas

1. If area is 50°F or below, sanitize daily, such as at the end of the shift.
2. If area is above 50°F, sanitize at mid shift and end of shift.
3. All equipment must be disassembled completely for cleaning and sanitizing.
4. Fish handling equipment -- in addition to cleaning and disinfecting, all surfaces should be final rinsed with 200 ppm chlorine sanitizer before start of operations in the morning.

Coolers - Floors and Walls

In fish coolers, after rough cleaning, flush floors daily with warm water, followed by applying 200 ppm (chlorine) sanitizing solution. Do not rinse solution. Following this, walls and ceiling must be wet down with sanitizing solution (200 ppm) which is left on.

If your cooler is moldy, (apparent by dark discoloration): scrub with detergents, rinse, spray with 1,000 ppm chlorine solution.

Frequently Overlooked Areas or Equipment

1. Ice Makers:
 - A. Turn off water and power; empty drain

- B. Clean thoroughly inside, including circulating the sanitizing solution through machine
- C. Rinse thoroughly
- 2. Air returns and grills: Should be cleaned weekly with vacuum hose
- 3. Hand Dips: 25 ppm iodine or 50 ppm chlorine
- 4. Restrooms: cleaned and sanitized daily
- 5. Vehicles:
 - A. Those used to transport non-perishable items must be rough-cleaned daily and sanitized on a weekly basis
 - B. Those that are used for perishables must be cleaned and sanitized daily

REFERENCES

Gillespie, S.M. and Schwartz, W.B. 1977. Seafood Retailing, 2nd ed. Texas Parks and Wildlife. Austin, TX.

APPENDIX VI

PACKAGING

The recent trend appears to be for food stores with seafood departments or counters, to offer full service displays, although some successful retail chains have stayed with self-service. Certain products, such as some value-added items may readily lend themselves to a self-service approach. Obviously, if seafoods are to be self-service then this necessitates a prepackaged product.

Several factors should be considered as part of packaging, including:

1. Product protection
2. Package durability
3. Appearance
4. Suitability to retail display
5. Consumer appeal

Most retailers probably consider the latter three factors, since these have the most obvious implications on consumer acceptance and therefore sales volume. However, the first two factors (product protection and packaging durability) also have definite implications in enhancing product quality and in control of product losses through freezing.

According to Borgstrom (1968), food packaging protect their contents during storage, before sales and in the home. They offer protection from contamination by dirt and other foreign material; from infestation by insects, rodents, and microorganisms; and from loss or gain of moisture. Certainly all of these attributes are important for fresh seafoods, particularly protecting against moisture loss in the retail display case.

In the discussion on shrinkage, the concept of freezing product not sold after 48 hours in the refrigerated case was introduced. If this concept is to be practiced by seafood retailers, then it would be advisable to overwrap fresh fish with a packaging film which is durable at freezer temperatures. Moreover, the characteristics which constitute a good freezer wrap are usually very desirable for refrigerated products.

Properties of a good packaging material for refrigerated and frozen storage should be:

1. **Moisture proof:** Loss of water during frozen storage results in a condition known as freezer burn. Also,

loss of water during refrigerated storage can accelerate loss of quality as well as loss of product weight.

2. **Low permeability:** Permeability refers to the rate at which the packaging material permits vapors and gases to pass between the product and the surrounding atmosphere. For frozen products, it is particularly important to use a film which possesses a low permeability to oxygen. This retards the development of oxidative rancidity.
3. **Tight fit:** A tight-fitting package is essential to prevent moisture loss inside a freezer package. In a loose-fitting package, moisture evaporates from the fish and condenses as ice crystals on the inside surface of the package. If the product is warmed slightly during defrosting or each time unfrozen material is placed next to frozen product, the moisture may move from the food surface to the package. When the package cools again, the cycle is repeated. This may continue until a large quantity of water is removed from the food, causing severe dehydration. For fresh items, a tight wrap makes the product appear glossy and reduces unsightly drip.
4. **Strong:** Wrapped products, whether frozen or refrigerated, are subject to abuse. The wrapping material may possess many desirable characteristics but all is in vain if easily punctured or torn.

Types of Packaging Film

There are numerous food packaging films on the market, and many of these could adequately serve the needs of both fresh and frozen seafood products. For lengthy frozen storage, however, only packaging materials designed for freezing should be used. Most standard meat films used for overwrapping are inadequate. It is beyond the scope of this manual to recommend a specific film, however, the table on page 107 may be helpful in understanding the properties of different types of packaging films.

Advantages and Disadvantages of Packaging

As with most any retailing practice, the decision to offer packaged seafood should be based on sound information. The Organization for Economic Co-Operation and Development (1970) identified several advantages and disadvantages which are still valid.

Advantages:

1. Weight and price of the contents can be determined before sale and marked on the package along with date of packing [or pull date].
2. Contents are protected against contamination from the outside.
3. Other commodities carried by the shopper are not contaminated by fish.
4. In some cases the shelf-life can be extended.
5. An attractive wrapping can enhance sales appeal.
6. Fish can compete on more equal terms with other wrapped food products in stores other than traditional seafood shops.

Disadvantages:

1. The formation of unsightly drip inside the package.
2. Accumulation of odor in the package.
3. Formation of condensation on the inside of the wrapper.
4. Spoilage of wrapped contents may go unnoticed.
5. Too much reliance may be placed on the packaging, while other quality aspects are ignored.

TYPES OF PACKAGES

There are three common forms of packaging used for fresh fish. These methods are vacuum pouch, overwrap and overpouch.

The vacuum pouch simply involves placing fish in a pouch and applying a vacuum to the open end to exhaust gases before heat sealing.

Overwrapping, as with red meats, consists of placing product on a styrofoam tray and wrapping the tray and its contents in a layer of transparent material.

The overpouch packaging combines components of both the vacuum pouch and the overwrap systems. The tray is placed in a plastic pouch and the open end is heat sealed.

Prepackaging

Although the trend in recent years is toward full service, there are several apparent advantages to prepackaged fish. Some of these advantages apply to the retailer and some to the consumer. Prepackaged fish, which are processed (dressed or filleted) and packaged at a centralized location, offer the retailer the following advantages when compared to a traditional service counter:

1. Less space required
2. Counter does not have to be continuously manned
3. Ease of product handling
4. Less odor
5. More conducive to sanitary handling
6. Attractive packaging can encourage impulse buying.

The advantages prepackaged fish offer the consumer are:

1. Convenience
2. Can be examined by the consumer for type, quantity, and price.

Prepackaged fish should not be regarded as possessing any additional shelf-life advantage. It is a means of presentation, not of preservation. There are methods of prepackaging fish to enhance shelf-life such as modified atmospheric packaging or vacuum packaging. These latter two methods of packaging are more expensive than traditional methods and there are still some unresolved questions regarding their safety. Nonetheless, it seems apparent that methods of packaging which enhance shelf-life expectation will be the wave of the future.

CHARACTERISTICS OF FREEZER PACKAGING MATERIALS

Material	Permeability		Tightness of Fit	Strength	Cost
	Water	Air			
Polyvinylidene Chloride (saran)	Low	Very Low	Very Good	Medium Low	Low
Polyvinyl Chloride P.V.C.	Low	Very Low	Very Good	Medium	Low
Polyester Bags and Sleeves	Very Low	Low	Good	High	Very Low
Polyethylene Wraps and Bags	Medium	High	Poor	High	Low
Cellophane	Very High	Medium	Fair	Low	Low

REFERENCES

- Borgstrom, G. 1968. Principles of Food Science. Vol. 1. Food and Nutrition Press. Westport, CT.
- Organization for Economic Co-Operation and Development. 1970. Packages and Packaging Material for Fish. OECD Publications. Paris, France.

BLANK
PAGE

APPENDIX VII

VALUE-ADDED PRODUCTS: A SHELF-LIFE STUDY

Fresh Atlantic Mackerel fillets were prepared by four recipes -- an acid marinade, a mayonnaise sauce, a coating of Cajun spices and a bread stuffing roll-up. These and an untreated control were tray packed raw and stored at 34° F. Periodically a package of each item was opened and evaluated for bacterial numbers and sensory quality. Results are summarized in the following table and graphs.

Table 1. Bacterial growth during storage of value-added fish (aerobic plate count / gram).

Storage day	Product Style				
	Control	Marinade	Sauce	Cajun	Roll-up
0	4.7x10 ³	3.5x10 ³	2.5x10 ³	9.3x10 ³	4.9x10 ³
3	4.4x10 ³	3.3x10 ³	2.3x10 ³	7.3x10 ³	1.0x10 ⁴
5	5.8x10 ⁵	3.9x10 ³	5.7x10 ³	1.1x10 ⁴	5.3x10 ⁴
7	7.7x10 ⁵	2.4x10 ⁵	4.5x10 ⁴	3.3x10 ⁴	1.1x10 ⁵
10	5.2x10 ⁸	2.0x10 ⁷	5.6x10 ⁵	5.2x10 ⁶	---
12	7.6x10 ⁸	1.1x10 ⁷	5.7x10 ⁵	5.7x10 ⁷	---

The bacteria counts in the table indicate little if any effect from the various products during the first few days of storage. However, the mayonnaise-base sauce and, to a lesser extent, the Cajun spice and marinade recipes appeared to slow microbial growth later. The rate that bacteria grow, and even the type of bacteria present, can be affected by ingredients that alter acidity, salt and fat contents (less available water), and exposure to oxygen.

The mayonnaise sauce used to coat mackerel fillets was acidic (pH 4) and high in oil content. Other researchers have also found mayonnaise to slow the growth of bacteria: a finding that contradicts conventional wisdom. The Cajun spice contains salt as the predominant ingredient, and the marinade contains acids (lemon and orange juices) and salt (soy sauce). The roll-up stuffing consisted mostly of lightly seasoned bread crumbs and probably had little direct effect on microbial growth.

Figures 1 through 6 chart changes during storage as determined by taste panelists using a nine-point scale. The scale ranges from nine (excellent) to one (dislike very much) for each of six quality characteristics. Not surprisingly, all of the attributes lost quality throughout storage. The appearance of the raw fillets in mayonnaise sauce was generally favored while the marinated fillets were least attractive, except on day 10 (figure 1). The unprocessed fillets (control) remained about average until a week or more into the study when they rated lowest.

The appearance of a product during the first few days in the store is essential for triggering sales. The study demonstrated that further processing may either improve appearance or detract from it. The odor of raw products gave results similar to appearance but the scores were more closely grouped and differences may not have been significant (figure 2).

Figures 3, 4, 5 and 6 record sensory scores for flavor, odor, texture and appearance of the products after cooking. Results generally followed trends observed for the uncooked items and for growth of bacteria. An exception was the marinade which apparently tasted better than it looked.

Texture scores were closely grouped, perhaps partially due to preference differences among panelists, but several observations are worth noting. The mayonnaise sauce seemed to retain a moister fillet than did the others during storage, possibly by creating an oil barrier. The salty Cajun coating produced a firmer product, especially near the fillet surface. And the roll-up stuffing became soggy toward the end of the study.

Overall, many factors have an impact on the success of value-added items; some related to the seafood and others to

ingredients. Initial impression will make those important first sales but only a pleasant experience at the table will bring customers back. The shelf-life of seafoods may be extended or shortened by making convenience products, but best results will always be achieved by preparing relatively small batches that can be sold quickly. Ingredients should not be relied on to preserve quality.

This work was partially funded and supported by the Mid-Atlantic Fisheries Development Foundation, Inc. (Grant 87-32-5000); the Office of Sea Grant, NOAA, U.S. Department of Commerce (Grant #NA86AA-D-SG-042); and by the Virginia Sea Grant Program. The U.S. Government is authorized to produce and distribute reprints for governmental purposes, notwithstanding any copyright that may appear hereon.

Virginia Tech does not discriminate against employees, students, or applicants on the basis of race, sex, handicap, age, veteran status, national origin, religion, or political affiliation. Anyone having questions concerning these regulations should contact the Equal Employment/Affirmative Action Office.