

## **Marketing Aquaculture Products: A Retail Market Case Study for SUNSHINE BASS**

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# **Marketing Aquaculture Products: A Retail Market Case Study for Sunshine Bass**

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Cover photograph by Rick Griffiths shows "Sunshine Bass Almondine" as prepared by Jim Sexton (see page 56).

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## Abstract

This research study addresses strategic questions about marketing of Sunshine Bass (a hybrid striped bass species) in a retail market outlet. The retail customers demanded high product quality and service from the market outlet. Successful marketing of Sunshine Bass in a retail outlet depends on economic conditions within the marketing channel. The elements in this study included: customers, pricing, marketing, and costs.

*Objectives.* The overall objective of the study was to analyze the physical distribution system for marketing Sunshine Bass in retail marketing outlets.

*Methods.* The study examined the physical distribution elements and costs in a retail marketing channel. Both physical distribution elements and cost data were analyzed by a marketing reconnaissance spreadsheet. The spreadsheet estimated marketing channel revenues and costs by assembly, processing, distribution activities, and product shrinkage. The input factors and their cost relationships were established. The elements focused on: production, harvest, and assembly, processing and distribution, and retail market evaluation.

*Results.* Most customers surveyed rated Sunshine Bass as a quality product. Most preferred a fillet form. About 70 percent said they would pay from \$6.00 to \$8.00 for a pound of fillets. Most customers surveyed were not familiar with the name, Sunshine Bass. Costs of physical assembly, distribution, and processing were calculated. For a whole-gutted product form, the per-pound cost of the assembly, processing, and distribution functions was about \$0.39. For a fillet product form, the per-pound cost of the assembly, processing, and distribution function was about \$.96.

*Conclusions.* Major promotional effort will be needed to penetrate the market, more technology application will be needed to reduce production and marketing costs, and more product development attention will be needed to build product value.

*Key words:* retail marketing, physical distribution, Sunshine Bass, marketing costs.

## Executive Summary

This research study asked and answered strategic questions about marketing of Sunshine Bass, an aquaculture product, in a retail market outlet. The successful marketing of Sunshine Bass depends on positive economic conditions within the marketing channel. The elements in this study included: customers, pricing, marketing, and costs.

### Customers

This study produced positive results about Sunshine Bass. The customer group surveyed demanded quality fish and fish products. The study found that consumers surveyed liked the taste of Sunshine Bass, preferred it in a fillet form, and (most) wanted a fillet priced between \$6.00 and \$8.00 a pound. When asked, customers said the taste of Sunshine Bass was similar to rockfish, orange roughy, or flounder. When making purchase decisions, customers compared the Sunshine Bass price to products with similar product characteristics (rockfish, orange roughy, and flounder). When the price of Sunshine Bass was significantly higher than for a similar tasting fish, an alternative species of fish priced lower was substituted for Sunshine Bass.

### Pricing

Pricing factors influencing the market for Sunshine Bass were studied. For a new product like Sunshine Bass, price discovery becomes a matter of trial and error. In retail seafood display cases, seafood managers merchandised Sunshine Bass products as one of 35 different, unbranded seafood products. The seafood managers had previously marketed a limited number of pond-raised hybrid striped bass as whole fish, but had not marketed any hybrid striped bass fillets.

During weeks one and two, the seafood manager displayed Red Snapper along with Sunshine Bass as a whole-fish product. During that period, the seafood manager priced Sunshine Bass at \$5.99 per pound and merchandised it as a whole-gutted fish. This product form didn't sell very well. After the two-week study, the seafood manager marketed the Sunshine Bass in a fillet form, and priced the fillets at \$8.99 per pound. Customers purchased the Sunshine Bass with encouragement from the seafood department sales persons. The last week of the study was conducted during the religious Lenten period.

## Marketing

The study concentrated on marketing procedures, physical distribution functions, and product shrinkage in a retail marketing channel. A market reconnaissance spreadsheet was created to summarize the study data and calculate the costs incurred in the marketing channel. The costs of two product-forms of Sunshine Bass were traced through the retail marketing channel by the spreadsheet (beginning with the retail market price and recognizing costs incurred until the producer receives his product's residual-value). A successful marketing venture must have the market outlet price cover all marketing costs and provide sufficient profit to retain capital in the marketing channel.

In a retail outlet, marketing margins for fish and shellfish products usually range from 30 percent to 50 percent. Consider this example. Assume a seafood manager sells a one-pound Sunshine Bass, whole-gutted, for \$5.99 with a 38 percent retail gross margin. The price of Sunshine Bass from a wholesale source would be about \$3.73 per pound. Dealers in the marketing channel, including the Sunshine Bass producer, must cover all their costs, and make a profit at the wholesale target price of \$3.73 per pound. Gross margins higher than 38 percent will force a lower wholesale target price. This lower wholesale target price, if all other channel costs are constant, will return a lower price to a Sunshine Bass producer.

Sunshine Bass marketed in a whole-gutted form in a retail market outlet where it is priced at or below \$3.73 will yield a producer price of about \$2.99 per pound. Except at the retail outlet, the \$2.99 producer price doesn't include any profit in the marketing channel. For a similar retail situation, a Sunshine Bass marketed in a fillet form, and priced at or below \$5.60 per pound will yield a producer price of about \$.30. If the cost of production were the same for both market forms, the producer would lose \$2.69 if his output is marketed in a fillet market form.

## Costs

Physical assembly, distribution, processing costs were calculated. For a whole-gutted product (often referred to in the trade as "drawn"), the per-pound cost of assembly, distribution, and processing was about \$0.39. For a fillet product form, the per-pound cost of assembly, distribution, and processing was about \$.96.

## Positioning Aquaculture Products in the Market

The aquaculture study team concentrated on defining and answering strategic questions about marketing aquaculture products in the market. The marketing issue was dealt with by studying one market channel and one product. Many marketing insights resulted from the effort. Results came from consumers in a competitive retail food market evaluating one aquaculture species marketed in two product forms. Procedures and resources needed to provide for consumer desire for aquaculture fish in the market were evaluated.

The research provided a structure to analyze the marketing of other aquaculture products. Four critical questions mapped the flow of information in the research gathering process.

- \* What aquaculture products will meet consumer expectations?
- \* What aquaculture products can be cultured in a recirculating facility?
- \* How will the aquaculture products be assembled, processed, and distributed?
- \* Can the concept and system be profitable and competitive?

The per-capita consumption of fish and shellfish and their derived products increased from about 14 pounds in 1980 to about 19 pounds in 1990. In the 1990s, per-capita consumption appears to be declining. During the 1980s, a large increase in the per-capita consumption growth was a result of imports and aquaculture products.

### Price

The retail market outlet (Graul's markets) that cooperated in the study marketed Sunshine Bass as a pricey item in their markets. Sunshine Bass product forms (whole-gutted and fillets) came to market at a relatively high price in comparison to other similar products (the price levels of Sunshine Bass merchandised as whole-gutted and as fillets ranked these products as some of the more expensive of the 35 products in the fish and seafood display case). Consumers didn't buy the whole-gutted Sunshine Bass with enthusiasm, but were more receptive to buying it in fillet form. The reason the market outlet placed a high price on Sunshine Bass was to determine whether it possessed a market appeal and would sell in the market. Sunshine Bass will face severe price

competition from the “rockfish” populations when governmental agencies open the public fishery to rockfish harvesters.

## **Quality**

Customers of the cooperating market outlet showed an active interest in the quality of the farm raised fish. Many customers volunteered information about their willingness to pay more for fish and shellfish produced under controlled conditions. Their concern about seafood safety created their desire to consume food products with a known origin of production.

## **Product form**

A product-form strategy was developed with the hope of capturing a segment of the whole baked “rockfish” market. Under this strategy, Sunshine Bass was marketed in a whole-gutted form. A whole baked “rockfish” remains a favorite (baked fish) recipe for customers in the Chesapeake Bay area. The Graul customers rejected the whole-gutted product form because of the smaller size, weight, and perceived value compared to the rockfish caught by commercial watermen.

The second product form of Sunshine Bass focused on the fresh, uncooked fillet. Graul’s seafood departments merchandise most of their marine products as fillet items. A product-form strategy for fillets featured capturing a segment of the fillet market. Graul customers accepted the fillet form better than they did the whole-gutted form.

## **Availability**

Sunshine Bass products are still scarce in the United States. Virginia produced about 70,000 pounds during 1989-1991. The Sunshine Bass industry is in a developmental phase, and therefore the market lacks a consistent supply of marketable products.

## **Promotion**

The Sunshine Bass promotional program featured in-store promotion only. The Graul markets didn’t promote the availability of the products in advance either by in-store or by press releases. The Sunshine Bass products were promoted in the store by four methods:

1. Pictures of product use and graphics on charts (3-foot square);
2. Sunshine Bass recipes on cards;
3. Sunshine Bass tasting demonstrations; and
4. Sunshine Bass products “for sale.”

Trained demonstrators offered Sunshine Bass samples to customers two days of each week during the period of inshore marketing. The demonstrators offered product information and individuals surveying the customers asked questions about the qualities of the Sunshine Bass.

## **Place**

The study gave careful thought to positioning the Sunshine Bass in a geographical market place. The selection of the Graul markets in Baltimore, Maryland, gave the study team an excellent location that was centered in the Chesapeake Bay area. A long-standing customer tradition of eating Chesapeake Bay "rockfish" opened the market "door" for sales opportunities for the hybrid striped bass called Sunshine Bass. The market location focused on customers who could make the transition from "rockfish" to Sunshine Bass. The Graul seafood departments presented the Sunshine Bass in an up-scale style market.

## **Quality maintenance**

Seafood buyers look for quality and value-priced seafood. The environmentally controlled harvest of aquaculture products provided buyers a high quality protein source for a regional market such as the Chesapeake Bay geographical area. Aquaculture products have the advantage of being harvested and processed immediately and for maintaining product quality in the marketing channel.

## **Consistent supply**

Recirculating aquaculture systems have the potential to provide a consistent supply of a product on an annual basis. At the same time, regulating temperatures in the system allows adapting the system for warm, cool, or cold-water fish targeted for a specific market.

## Introduction

The idea for conducting this hybrid striped bass physical distribution study was initiated by a group of food industry researchers. Three of the researchers were associated with private groups and four with public agencies. They included graduates of Virginia Tech; food industry executives; faculty and staff of Virginia Tech; administrators and staff of the Maryland Department of Agriculture; and professionals from the U. S. Department of Agriculture. The research ideals attracted the interest of members of the aquaculture industry.

The researchers met in Washington, D.C., in April 1988 to form a hybrid striped bass marketing study team (See Appendix 1). They discussed and outlined the physical distribution study and developed the study objectives and plan. At that meeting, the market research group created three working-subcommittees that formed the core of leaders to cover each task in the study.

The marketing research group chose Sunshine Bass, a hybrid striped bass, for the study. Named by the American Fisheries Society, Sunshine Bass is a hybrid created by a genetic cross between white bass (*Morone chrysops*) and striped bass (*Morone saxatilis*).

The group focused the marketing and distribution study on three economic sectors: (1) production, harvest, and assembly, (2) processing and distribution; (3) retail marketing and evaluation. The research steps in the study followed the Sunshine Bass from the production tank to the market outlet to the customer.

In the marketing channel, the Sunshine Bass were grown by aquaculturalists. Their tasks included: growing the fish in tanks and removing them from the tanks; weighing, measuring, and packing them on ice in wax-coated boxes; and transporting them for processing. In the second channel sector, a seafood processor's tasks included processing the Sunshine Bass into a specified market form, packing the product in ice in a market-package, and delivering it to the retail store. In the third channel sector, a food retailer incorporated customer, retail marketing, and evaluation tasks.

## Objectives of the Study

The overall objective of the study was to analyze the physical distribution aspects of marketing hybrid striped bass, Sunshine Bass, in retail marketing outlets.

The specific objectives included:

1. estimating variable and fixed costs of physical distribution,
2. assessing the handling procedures for maintaining product quality and shelf life,
3. assessing microbial growth of pathogens given the physical distribution methods, and
4. assessing product forms and consumer acceptance of the Sunshine Bass.



## The Method of Analysis

The physical distribution study collected, described and examined the elements and cost data in a retail marketing channel. A spreadsheet was created to summarize and analyze the physical data and calculate the costs incurred in the marketing channel (See Figure 1). Data were collected in each sector in the marketing channel. The data collection methods defined beginning and ending points in each channel sector. The spreadsheet provided cost summaries for assembly, processing, and distribution tasks.

### A marketing reconnaissance spreadsheet

A marketing reconnaissance spreadsheet created for the study describes product relationships in a marketing channel by estimating sector prices, sector costs, and product values. A spreadsheet is presented in Figure 1. In the example, the retail marketing channel consisted of three sectors: assembly, processing, and distribution. A production unit provided the fish and a retailing unit marketed them. Assembly connected the producing and the processing sectors. Distribution coupled the processing and the retailing sectors. The food retailer set the Sunshine Bass price based on the price of competing products in the seafood department.

Once the model was created, the economic value of Sunshine Bass was calculated by channel sector using the spreadsheet. The spreadsheet operated by multiplying a unit price and a product quantity produced in each marketing channel sector. The sector value was determined by product price and quantity in revenue dollars. The total costs accrued for each sector consisted of the variable costs and the fixed costs. The cost per pound estimate, working down the marketing channel from the retail outlet to the production unit, represents the price per pound at the producing unit. The profitability of the production unit was the difference between the producer's price and the cost of operation during the production cycle.

*Of special note:* Using the spreadsheet, we calculated the value of waste tissue (head, viscera, etc.) shrinkage as the Sunshine Bass moved through the marketing channel. Product shrinkage changed the product value as the Sunshine Bass form was changed in the channel. As a result of the shrinkage calculations, realistic estimates of the Sunshine Bass value indicate the value of the fish at the production facility.

The market reconnaissance spreadsheet linked the physical distribution data bases together and calculated a solution at the production unit based on a retail price (See Figures 1 and 2). The spreadsheet enabled a producer to conduct market reconnaissance by entering an expected retail price for Sunshine Bass and estimate the economics by sector throughout the marketing channel resulting in an estimated price. The physical distribution data base reflected the spreadsheet values (See Tables 11-15).

The marketing reconnaissance spreadsheet was designed as a static model that would analyze the aquaculture marketing scenario in two ways. First, the spreadsheet targets a retail price for the aquaculture commodity, in this case Sunshine Bass. Second, it estimates the market potential by incorporating the marketing costs in each channel sector to determine the fish value at the production unit.

The marketing reconnaissance spreadsheet determined the economic results for Sunshine Bass in the whole-gutted product form (See Figure 1). The information shown consists of the flow of product, product form, unit price, unit cost, quantity of product, and value in dollars. The spreadsheet presents information for each sector.

The marketing reconnaissance spreadsheet results are based on the three weeks of data collected. These results may contain certain measurement and estimating errors based on sample size and other collection constraints.

### **Whole-gutted Sunshine Bass (See Figure 1)**

*The retail sector.* The retail price of Sunshine Bass, offered to the consumer, is shown in the retail sector. The customer is offered Sunshine Bass in a product form of whole-gutted fish (with the head and fins on the fish). The seafood retailer sets the price of Sunshine Bass at \$5.99 per pound at the seafood counter. The retailer subtracts from the price set a 37.75 percent gross margin for covering his costs for handling the Sunshine Bass (Figure 1, footnote). Given the retail gross margin, the retailer pays the supplier a price of \$3.73 per pound (See in Figure 1, cell C11). The 37.75 percent retail gross margin, \$2.26 per pound, covers the retailer's costs and profit needs.

*The processing sector.* The processing sector of the spreadsheet gives the price, cost, and shrinkage impacts for Sunshine Bass offered to the retailer in the whole-gutted product form. The processor subtracts his costs of fish cutting, handling, packaging, and shrinkage in the processing operations. The processor sets the retail "going-in" price for whole-gutted Sunshine Bass at \$3.73 per pound. This price must cover costs

and allow for profit in the processing, physical distribution, and production units. For whole-gutted fish, the variable processing costs amounted to about \$0.33 per pound (See in Figure 1 cell C23). The impact of shrinkage in the Sunshine Bass whole-gutting process removed about 889 pounds of waste product in a 12,500 pound truck-load lot of Sunshine Bass (See in Figure 1, cell D19). The 889 pounds of waste must be disposed of or, preferably, sold to recover some value of the fish lost to the gutting process.

**Figure 1. Marketing Reconnaissance Spreadsheet\***  
Commodity = Whole gutted Sunshine bass

	A	B	C	D	E
8	Product Flow Section	Product Form	Unit Price	Quantity (Pounds)	Value (Dollars)
9	RETAILING				
10	Price of Retail	Gutted Fish	5.99	11333	67887
11	Price from Processing	Gutted Fish	3.73	11333	42259
12	Shrinkage		N/A		
13	Variable Costs		N/A		
14	Fixed Costs		N/A		
15	Cost/Pound (Retailing)		.00		
16	PROCESSING				
17	Price of Processed Product	Gutted Fish	3.73	11333	42259
18	Price after distribution	Gutted Fish	3.16	12222	38167
19	Shrinkage %	.07		889	
21	Variable Costs		.33		
22	Fixed Costs		N/A		
23	Cost/Pound (Processing)		.33		
25	PHYSICAL DISTRIBUTION				
26	Cost to Processing	Fish	3.12	12222	38167
27	Price at the Farm	Fish	3.06	12500	37375
28	Shrinkage %	.02		278	
30	Physical distribution				
31	Cost/Pound (Distribution)		.06		
33	PRODUCTION				
34	Residual Price Production	Fish	2.99	12500	37375

Based on Retail Gross Margin of 37.75 percent.

\*Values calculated based on Tables 11-14.

Note: Model is market driven and price is set at retail. The producer is the residual claimant.

Developed by: C. W. Coale and G. D. Spittle .

*The physical distribution sector.* The physical distribution sector includes both assembly and distribution functions. The distribution sector gives the cost and shrinkage impacts for Sunshine Bass offered to the processor and, in turn, the retailer. The producer moves the whole Sunshine Bass to the processor, and the processor moves the Sunshine Bass in the whole-gutted product form to the retailer. The distribution sector gives both the cost of physical distribution and the cost of shrinkage of the gutted Sunshine Bass. Distribution included the cost of truck use, the driver, and the in-transit shrinkage of the product. The physical distribution costs amounted to \$0.06 per pound (See in Figure 1, cell C31). The impact of shrinkage in the distribution function amounted to 278 pounds in an original 12,500 pound truck-load lot of Sunshine Bass (See in Figure 1, cell D28).

*The producing sector.* The information shown for the producing sector includes the estimated producer price (residual price) at the production unit. The importance of this estimate is that it gives the expected price for Sunshine Bass at the production unit once a retail price is established that covers all marketing channel costs. The retail price of Sunshine Bass will vary based on market conditions. For this study, a producer price of \$2.99 resulted after the marketing costs had been subtracted (See Figure 1, cell C34). In a commercial situation, other operators in the marketing channel would expect to recover profit for their management. The producer price of \$2.99 would likely be reduced because of the profit incentive.

## **Fillets, Sunshine Bass (See Figure 2)**

*The retail sector.* The retail sector gives the retail price of the Sunshine Bass product form offered to the consumer (See in Figure 2, cell C9). The product form is a Sunshine Bass fillet. The retailer sets a 37.75 percent gross margin for covering the costs for handling the Sunshine Bass fillet in the seafood department (Figure 2, footnote). The retailer establishes a price for the Sunshine Bass at \$8.99 per pound at the seafood counter. Given the gross margin, the retailer pays the supplier \$5.60 per pound, which means that a price of \$5.60 has been established to cover all of the costs and profit in the retail channel. The 37.75 percent gross margin, which equals \$3.39 per pound, covers the retail costs and profit.

*The processing sector.* The processing sector gives the price, cost, and shrinkage impacts for Sunshine Bass offered to the retailer. For this example, the processor offered Sunshine Bass to the retailer in a fillet product form. The processor subtracts his costs for fish cutting, handling, packaging, and shrinkage in the processing operations.

**Figure 2. Marketing Reconnaissance Spreadsheet\***  
Commodity = Filleted skin-off Sunshine Bass

	A	B	C	D	E
6	Product Flow Section	Product Form	Unit Price	Quantity (Pounds)	Value (Dollars)
8	RETAILING				
9	Price of Retail	Fillets	8.99	177	1593
10	Price from Processing	Fillets	5.60	177	992
11	Shrinkage		N/A		
12	Variable Costs		N/A		
13	Fixed Costs		N/A		
14	Cost/Pound (Retailing)		.00		
16	PROCESSING				
17	Price of Processed Product	Fillets	5.60	177	992
18	Price after distribution	Fish	.95	760	1719
19	Shrinkage %	.77		582	
	Cost of Shrinkage				
21	Variable Costs		.36		
22	Fixed Costs		N/A		
23	Cost/Pound (Processing)		.36		
25	PHYSICAL DISTRIBUTION				
26	Cost to Processing	Fish	.95	760	719
27	Price at the Farm	Fish	.30	800	
28	Shrinkage %	.05		40	
	Cost of Shrinkage				
30	Cost of physical distribution				
31	Cost/Pound (Distribution)		.60		
33	PRODUCTION				
35	Residual Price Production	.00	.30	800	240

Based on Retail Gross Margin of 37.75 percent

\*Values calculated based on Tables 11-14.

Note: Model is market driven and price is set at retail. The producer is the residual claimant.

Developed by: C.W. Coale and G.D. Spittle.

The processor estimated the Sunshine Bass target price at \$5.60 per pound (See in Figure 2, cell C17). For Sunshine Bass fillets, a price of \$5.60 should cover all the costs and profit in the processing, physical distribution, and production sectors. For fillets, the processing costs were

about \$0.36 per pound (See Figure in 2, cell C23). The shrinkage incurred in the filleting process amounted to 582 pounds in an 800-pound truck-load lot of Sunshine Bass (See Figure in 2, cell D19). The 582.46 pounds of waste must be disposed of or sold to recover the value of the fish lost to the fillet process. The costs in the processing sector leave \$0.95 per pound for the physical distribution and processing sectors (See in Figure 2, cell C18).

*The physical distribution sector.* The physical distribution sector includes both assembly and distribution functions. A vehicle with a smaller capacity was used for distribution of Sunshine Bass in fillet form. The producer performs the assembly function of moving the whole Sunshine Bass to the processor. The distribution sector of the spreadsheet gives the cost and shrinkage impacts for Sunshine Bass offered to the processor and retailer. The processor moves the filleted Sunshine Bass to the retailer. The distribution sector here includes the cost of physical distribution and shrinkage. The costs associated with distribution include the truck-use, expenses of a truck driver, and shrinkage of the product in transit. These variable costs for distribution amounted to \$0.63 per pound. Measurements show that the product's in-transit shrinkage amounted to about 5 percent, or 40 pounds (See in Figure 2, cells D28).

*The producing sector.* The price and cost data indicate the residual price for the producer. The importance of this estimate is that it gives the producer price for Sunshine Bass once a retail price has been established and all marketing channel costs covered. In the test, after the marketing costs were deducted, a producer price of \$0.30 per pound was left (See in Figure 2, cell C35). Again, as in the whole-gutted situation, handlers operating in a marketing channel would expect to recover profit from channel revenues for their management. The producer price of \$0.30 would likely be reduced because of the profit incentive.

## **The input-cost matrix in the spreadsheet**

An input-cost matrix used in the marketing reconnaissance analysis was used to summarize input costs related to the marketing of Sunshine Bass. The input cost data in the linked spreadsheet can be varied if conditions change. By recalculating the spreadsheet, new marketing cost estimates result. The input-cost matrix in Figure 3 gives the results of a three-week market test, with the data organized by each input category and by weeks one, two, and three.

The input-cost matrix identifies economic units as either physical or dollar units (See in Figure 3, the input item in column A, and units of

measure in column B). The reader interprets the input-cost matrix by reading columns A through E by row. The matrix indicates the input, its unit of measurement, and its physical relationship. For example, row 10 indicates that a 20-foot truck rents on a daily rental rate basis for \$65.00. All information found in Figure 3 is used in calculating the study costs.

**Figure 3. Input-cost Matrix for Sunshine Bass Study, 1990-91.**

	A	B	C	D	E
4	INPUT ITEM	UNIT	WEEKS		
6	PHYSICAL DISTRIBUTION INPUTS		ONE	TWO	THREE
7	TRUCKS				
8	20' REFRIGERATED				
9	CAPACITY	LBS	12500.00	12500.00	
10	RYDER/DAY RENT	\$/DAY	65.00	65.00	
11	RYDER/WEEK RENT	\$/WEEK	325.00	325.00	
12	RYDER VARIABLE COST	\$/MILE	.12	.12	
13	PERFORMANCE	MILES/GAL	7.00	7.00	
14	FUEL COST	\$/GAL	1.36	1.36	
15	FUEL COST	\$/MILE	.19	.19	
16	THERMO-KING COST	\$/HOUR	.30	.30	
17	THERMO-KING OPS	HOURS	9.50	9.50	
19	9' UNREFRIGERATED				
20	CAPACITY	LBS			800.00
21	VIRGINIA TECH/RENT	\$/MILE			.22
23	DRIVER--TRUCK				
24	DRIVER TIME	\$/HOUR	7.50	7.50	7.50
25	DRIVER EXPENSES	\$/DAY	50.00	50.00	50.00
27	FISH ASSEMBLED	LBS	651.00	288.60	351.50
28	FISH DISTRIBUTED	LBS	585.60	259.20	83.20
29	SHRINKAGE FACTOR	PCT	.10	.10	.76
30	PROCESSING INPUTS				
31	WHOLE FISH PER BOX	LBS	40.00	40.00	40.00
32	FILLETS PER BOX	LBS	10.00	10.00	10.00
34	SHIPPING CONTAINER	\$/BOX	1.35	1.35	1.35
35	ICE COST	\$/LB	.10	.10	.10
36	ICE PER CONTAINER	LBS	20.00	20.00	20.00
37	CUTTING FISH	\$/LB	.30	.30	.30
38	PLASTIC SHIPPING TUB	\$/TUB	1.00	1.00	1.00

The values in Figure 3 summarize the units used weekly. The economic input-values include the truck, driver, fish, and container inputs. The input-values in Figure 3 apply to the cost analysis presented by Tables 11 through 15 in the assembly, processing, and distribution sectors of the marketing channel.

During the study two trucks of different-sizes were used for assembly and distribution of Sunshine Bass: a 20-foot, refrigerated body; and a 9-foot, unrefrigerated van. The 20-foot truck hauled Sunshine Bass during weeks one and two. A 9-foot van transported fish during week three. The input-factors differed for each size truck.

The vehicle in week three cost \$0.22 cents per mile. A charge of \$0.22 cents changed the cost relationship from the equipment used in weeks one and two. The cost factor entered the calculation in the assembly and distribution spreadsheet. The input-factors for each truck consisted of about eight different measures. These measures include: truck hauling capacity; rental costs by day and week; operating cost per mile; performance by miles per gallon of fuel; fuel cost; and refrigeration cost for fuel and operations. For drivers, the factor inputs included the cost of their time and expenses. The driver costs described in Figure 3 represent the cost of a commercial driver. The volume of fish transported differed in weight each week. The weight per box remained constant, based on the product form: whole-gutted or fillet. Packaging material inputs included food-quality ice and containers.



## Scope and Study Procedures

Data collection and observation focused on the tasks of harvesting and assembly, processing, distributing, and retailing. At retail, product demonstrators offered morsel-size samples of baked Sunshine Bass to customers. The purpose for giving retail customers a Sunshine Bass morsel was to encourage them to share information about the product. In turn, if customers liked the sampled product, they could buy the Sunshine Bass from the seafood department.

In the store, shoppers were asked questions about the value attributes of Sunshine Bass. They also suggested purchase of the Sunshine Bass from the retail seafood department for further evaluation. Customers could choose either of two product-forms of Sunshine Bass: whole-gutted or filleted. These purchase options were available after the tasting demonstration. The fillets provided many preparation alternatives.

The inshore study began on October 15, continued for two weeks, and ended on October 27, 1990. The original marketing plan called for a three-week study. By October 1990, the Sunshine Bass had not reached a desired weight of one and one-half pounds, but the study committee agreed to begin. During the two weeks, Graul consumers did not buy many of the whole-gutted Sunshine Bass and the committee agreed to postpone the study until the Sunshine Bass reached a more desired weight. The third week of the study began on March 18 and ended on March 23, 1991.

### Pre-harvesting

Virginia Tech faculty conducted before-harvest sensory taste panels according to the following schedule: two months, one month, and 24 hours. Laboratory workers in the Department of Food Science prepared Sunshine Bass samples at 400 degrees Fahrenheit for 15 minutes in sealed aluminum foil and served 15 trained panelists. Each panelist rated the samples based on a sensory evaluation worksheet for appearance, odor, texture, and flavor on a 9 point hedonic scale (See Figure 4).

### Growing

The Department of Fisheries faculty grew the Sunshine Bass in the Virginia Tech recirculating aquaculture system and used them for the market study. The faculty followed a defined management and production schedule, kept records on cultural techniques and resources used.

## Harvesting

The fisheries' staff harvested the Sunshine Bass on Monday mornings at 7:00 a.m. and packed them in ice. The Sunshine Bass were packed 40 pounds in each box. After packing, Sunshine Bass were kept at a desired temperature by the ice pack and supplemental refrigeration and insulation.

**Figure 4. Sensory Evaluation Worksheet**

Name: \_\_\_\_\_

Product: \_\_\_\_\_

Sample Number: \_\_\_\_\_

Rating	Characteristics			
	Appearance	Odor	Texture	Flavor
Excellent	_____	_____	_____	_____
Very Good	_____	_____	_____	_____
Good	_____	_____	_____	_____
Fair	_____	_____	_____	_____
Borderline	_____	_____	_____	_____
Slightly poor	_____	_____	_____	_____
Poor	_____	_____	_____	_____
Very poor	_____	_____	_____	_____
Inedible	_____	_____	_____	_____

Comments:

9 = Excellent \_\_\_\_\_

8 = Very Good \_\_\_\_\_

7 = Good \_\_\_\_\_

6 = Fair \_\_\_\_\_

5 = Borderline \_\_\_\_\_

4 = Slightly poor \_\_\_\_\_

3 = Poor \_\_\_\_\_

2 = Very poor \_\_\_\_\_

1 = Inedible \_\_\_\_\_

## **Assembling**

Sunshine Bass were hauled directly to a processing plant. The assembly process consisted of a direct route from Blacksburg to Hampton, Virginia. They included highways: US 460, Interstate 81, and Interstate 64. The Sunshine Bass arrived in Hampton, Virginia about six to eight hours after harvest.

## **Processing and distributing**

During the first two weeks of the study, workers at the L. D. Amory seafood processing plant gutted the Sunshine Bass on Tuesday morning. In weeks one and two, workers packed the fish by size categories. The Sunshine Bass weight distribution ranged from 0.5 pounds to about 0.9 pounds. The gutted fish weighed just less than one pound on average, though some of the smaller fish weighed about one-half pound. During week three, workers cut Sunshine Bass into a fillet market form.

During weeks one and two, workers gutting Sunshine Bass packed the larger fish inside a large plastic bag with ice, and packed the smaller drawn Sunshine Bass in 12"x 12" plastic bags and stored them in a large plastic bag with ice. In week three, workers skinned fillets, packed the fillets in a plastic tub, packed the tubs in a bag of ice, and placed the bag in a wax-coated fish box.

After processing during weeks one and two, Sunshine Bass were stored overnight. During week three, Sunshine Bass were stored in a refrigerated cooler and transferred to a non-refrigerated van for distribution.

Four Graul markets received the Sunshine Bass. The distribution process began in Hampton at 6:00 a.m. on Wednesday. All shipments were off-loaded at the Graul Stores by 4:30 p.m. At each store, the seafood department manager met the truck, inspected the product, and signed for the shipment. Store workers moved Sunshine Bass directly into the seafood department cooler.

## **Retail marketing**

Four Graul's Markets, located in the Greater Baltimore area, served as the market outlet for the Sunshine Bass study. The food retailer asked that the Sunshine Bass be merchandised with the skin-off because all competing fish in his display case were merchandised with the skin-off. One method of identifying the Sunshine Bass fillet is by the unique pattern of the skin. We believe that retailers should merchandise Sunshine Bass in a fillet form with the skin-on for species identification. The research program conducted in the marketing outlets consisted of introducing the customer to the product by offering prepared morsel-

sized samples of Sunshine Bass for a taste and suggesting purchase of the Sunshine Bass after taste tests. A chart with four pictures of the growing system was displayed in week one and two and showed recipes. The chart was redesigned and showed prepared Sunshine Bass during week three.

### **Inshore demonstrations and product sales**

Graul employees offered Sunshine Bass tasting morsels to customers and conducted inshore demonstrations on Friday, October 19, 26, and March 22; and on Saturday, October 20, 27, and March 23. Sunshine Bass was offered for sale on a daily basis during the three market test.

### **Quality assurance**

Five controlled steps, in the research procedures, provided customers with high quality Sunshine Bass.

1. **Step one:** Sunshine Bass muscle food quality was monitored by a sensory panel before harvest.
2. **Step two:** Product temperatures were maintained using ice and refrigeration during transportation, storage, and processing to prevent quality loss.
3. **Step three:** Processed fish were monitored for total aerobic plate count, psychrotrophic plate count, coliform count, and fecal coliform count.
4. **Step four:** Products were evaluated for physical quality attributes (odor and workmanship) according to standards published in CFR Title 50 by the U.S. Department of Commerce, National Marine Fisheries Service.
5. **Step five:** Temperatures in the retail stores were maintained at no greater than 40 degrees F during storage and display.

## **Consumer Acceptance of Sunshine Bass**

The Sunshine Bass is a “new” aquaculture fish species to the seafood consumer. Because of its lack of a continuing market presence, the name “Sunshine Bass” tended to confuse customers who purchased it. The Graul employees tried many “names” in their effort to compare the Sunshine Bass to the rockfish species from Atlantic waters.

Consumer acceptance of the Sunshine Bass and its product forms was studied. During weeks one and two, Sunshine Bass was marketed in the whole-gutted product form. During this period, survey persons asked 841 customers what their impressions were about Sunshine Bass and told them that the whole-gutted product was for sale in the seafood department. During study week three, survey teams talked with 430 customers and told them that Sunshine Bass fillets were for sale. The questions customers were asked and their responses appear in the narrative and tables following.

### **Whole-gutted product-form, 1990**

During inshore demonstrations, Graul employees offered customers a baked, one ounce, Sunshine Bass morsel. By offering a taste sample, a reference point was created to highlight the attributes of Sunshine Bass.

The customers walked through an area of the store where product demonstrators offered Sunshine Bass. At the same time, customers read and viewed a poster detailing the product qualities of Sunshine Bass and its preparation alternatives.

A Graul employee offered a morsel of Sunshine Bass almondine to customers that walked by the demonstration table (See recipe in Appendix 3). A survey person asked each customer who tasted a sample several questions. The first question dealt with the overall product attributes (See Table 1).

The Sunshine Bass product attributes included texture, taste, and quality. About 53 percent of the customers said the Sunshine Bass was either good or acceptable. About 1 percent said the product sample was unacceptable. About 46 percent of the customers did not offer a response to the question. Many of the customers appeared reluctant to make a decision about rating the product attributes.

**Table 1. How would you rate the texture, taste, and quality? (1990)**

Response	Frequency	Percentage	Cumulative percentage
Good	436	49	49
Acceptable	35	4	53
Unacceptable	9	1	54
No response	414	46	100
Total respondents	894		

Customers were asked if they would buy the fish (See Table 2). Survey persons asked customers to respond to the question without the customer having the benefit of seeing the fish, being quoted a price, or observing the fish case for product comparison. Customers responded to the question based on only the product taste-test. About 94 percent of the customers surveyed indicated they would make purchases of the fish based on its taste. About 5 percent of the customers said they would not buy Sunshine Bass based on its texture, taste, or quality in the taste test. About 1 percent of the customers didn't respond to the "purchase" question.

**Table 2. After tasting it, would you buy Sunshine Bass? (1990)**

Response	Frequency	Percentage	Cumulative percentage
Yes	842	94	94
No	40	5	99
No response	12	1	100
Total respondents	894		

Customers were asked about their price inclinations for Sunshine Bass in a fillet product form (See Table 3). Responses were based on customer opinions and not on direct product purchases. Surveyors asked customers about a range of unit prices (per pound) they would be willing to pay for Sunshine Bass fillets. During weeks one and two, the study team merchandised the whole-gutted form of Sunshine Bass products "for sale" in the seafood department. During weeks one and two, surveyors asked about customer preferences for fillet product form. About 71

percent of the customers indicated they would be willing to pay from \$6.00 to \$8.00 per pound. About 6 percent of the customers said they would pay from \$9.00 to \$11.00 per pound. Less than 1 percent said they would be willing to pay \$12.00 or more per pound. Of the 894 customers in the study, 22 percent did not respond to the survey question.

**Table 3. What purchase price would you pay for Sunshine Bass fillets? (1990)**

Response	Frequency	Percentage	Cumulative percentage
<i>\$/pound</i>			
\$6-8	633	71	71
\$9-11	57	6	77
Over \$12	4	Less than 1	77
No response	200	22	100
Total respondents	894		

A price lower than \$6.00 was not offered, based on economic factors (cost of processing, shipping, etc.).

Customers were asked to rate the quality of Sunshine Bass compared to other fresh fish alternatives (See Table 4). Customers were given three categories from which to choose; better, as good, or not as good. About 20 percent of the respondents said the Sunshine Bass tasted better than other fresh-fish alternatives. About 69 percent said that Sunshine Bass was as good as other fresh-fish alternatives. Altogether, about 89 percent of the interviewees believed Sunshine Bass was better or as good as other fresh fish possibilities. About 6 percent of the customers thought the quality of the Sunshine Bass served was not as good as other fresh fish. About 5 percent of the customers didn't respond to the question.

**Table 4. How would you compare the quality of Sunshine Bass to other fresh fish? (1990)**

Response	Frequency	Percentage	Cumulative percentage
Better	176	20	20
As good	619	69	89
Not as good	53	6	95
No response	46	5	100
Total respondents	894		

Customers were asked about their preference for size and weight of the Sunshine Bass. In its market product-form, the aquacultured Sunshine Bass tends to be smaller than wild-caught rockfish. About 12 percent of the customers surveyed said that size did affect acceptability of the Sunshine Bass (See Table 5). About 83 percent of the customers said size didn't affect its acceptability and 5 percent didn't respond to the question. Purchase-decision observations revealed that the size and weight of Sunshine Bass was a marketing issue with customers. Once customers saw the size of the fish and compared its size to other species, they complained that the Sunshine Bass was too small to meet their needs.

Typically, the market size and weight relationship of Sunshine Bass have been smaller than "wild caught" rockfish. The size difference results from striped bass having a longer growing period (three to five years) before harvesting. The growth charts show striped bass gain about one pound per year for the first two years of growth. Typically, retail seafood departments merchandise rockfish weighing three pounds or more. These weights have set the market size expectations for seafood customers.

**Table 5. Does a smaller size fish affect acceptability? (1990)**

Response	Frequency	Percentage	Cumulative percentage
Yes	105	12	12
No	746	83	95
No response	43	5	100
Total respondents	894		

The Graul's seafood department had marketed pond-raised hybrid striped bass for about nine months before the Sunshine Bass marketing study. Survey persons asked customers whether they had bought Sunshine Bass and were familiar with the product. About 7 percent of the customers had bought Sunshine Bass preceding the study. (Note: Some respondents may have purchased Sunshine Bass during the first week of the study and reported it during the second week of the study.)



**Table 6. Did you buy Sunshine Bass before? (1990)**

Response	Frequency	Percentage	Cumulative percentage
Yes	60	7	7
No	753	84	91
No Response	81	9	100
Total respondents	894		

### **Fillet product form, 1991**

During the third week, the study team merchandised Sunshine Bass only in a fillet product form. The study was conducted during the week of March 18, 1991. The same research procedures that were applied to the first market test during October 1990 were applied during the third week. But they made two important changes in the study concerning merchandising of the product. First, researchers changed the Sunshine Bass information charts to show the prepared product on a plate instead of in the aquaculture production system method shown in the earlier study period. Second, rather than as a whole-gutted fish, customers found Sunshine Bass merchandised in a fillet form.

As before, Sunshine Bass morsels were offered to customers as they walked by the demonstration space. The product demonstrators offered a Sunshine Bass almondine sample for tasting. After the customer tasted the product, survey persons asked customers several questions.

During the third week, the first survey question asked how satisfied the customer was with the overall product attributes; texture, taste, and quality (See Table 7). About 54 percent of the customers said the product was good or acceptable, and only 2 percent said it was unacceptable. About 44 percent did not respond to the question. Many of the customers appeared reluctant to make a decision about rating the product attributes. Only 1 percent of the customers tasting the product said it was unacceptable. The survey results between test one and two differed very little in rating Sunshine Bass over the six month period.

**Table 7. How would you rate the texture, taste, and quality? (1991)**

Response	Frequency	Percentage	Cumulative percentage
Good	215	50	50
Acceptable	17	04	54
Unacceptable	9	02	56
No response	189	44	100
Total respondents	430		

During the first test, the study team merchandised Sunshine Bass as whole-gutted products. Since the whole-gutted Sunshine Bass did not sell well during the first test, customers were asked what market form they usually bought (See Table 8). Of the 430 respondents to the survey, 89 percent preferred the fillet form. Only 11 percent preferred the whole-gutted form for Sunshine Bass.

**Table 8. What product-form would you normally buy? (1991)**

Response	Frequency	Percentage	Cumulative percentage
Product form			
Filletts	377	89	89
Whole fish	45	11	100
Total respondents	430		

After tasting, customers were asked what other fish compared to Sunshine Bass (See Table 9). Some 29 percent cited rockfish. About 9 percent named trout as a like-tasting product. About 13 percent thought Sunshine Bass tasted like orange roughy - a fish caught in the Southern Pacific Ocean. About 1 percent thought Sunshine Bass tasted similar to other fish species not previously named. About 48 percent of the customers did not give a response to the question.

**Table 9. What fish compares with Sunshine Bass? (1991)**

Response	Frequency	Percentage	Cumulative percentage
Rockfish	124	29	29
Trout	40	09	38
Orange Roughy	56	13	51
Other	06	01	52
No response	204	48	100
Total respondents	430		

The Graul Markets were merchandising limited quantities of pond-raised hybrid striped bass during 15 months before the Sunshine Bass study. Consumers were asked whether they had bought or if they were familiar with Sunshine Bass (See Table 10). About 7 percent had purchased Sunshine Bass before the second market test. On a percentage basis, customers purchasing Sunshine Bass during tests one and two did differ.

**Table 10. Did you buy Sunshine Bass before? (1991)**

Response	Frequency	Percentage	Cumulative percentage
Yes	28	07	07
No	397	92	99
No response	5	01	100
Total respondents	430		

## Conclusions

- a. Informal observations revealed confusion among customers because of the name, "Sunshine Bass." This confusion resulted because of a lack of market familiarity with the species. Not only were customers unfamiliar with Sunshine Bass, they were also uncertain of its value when making comparisons with other available fish on display. This unfamiliarity led to customers having many questions about the Sunshine Bass, ranging from its origin to the way it could be prepared.

- b. About 94 percent said they would purchase Sunshine Bass based on its quality; thus, a market niche appears to be positioned for the product forms offered in the market research.
- c. Based on interviews of Graul customers about product price, the target price for Sunshine Bass fillets should range between \$6.00 and \$8.00 per pound. As the price per pound increases to \$9.00 and \$11.00 per pound, only a small group indicated a willingness to purchase the products. A price lower than \$6.00/lb. was not offered, based on economic factors (cost of processing, etc).
- d. Based on taste tests, participating customers were satisfied with the taste of the Sunshine Bass.
- e. Given the test market sales, Sunshine Bass may have a better acceptance if the size and weight were larger than those merchandised in the marketing study.
- f. Based on interviews, Graul customers preferred Sunshine Bass fillets to the whole-gutted product form.
- g. Based on the spreadsheet analysis and test market prices, the whole-gutted Sunshine Bass would be more profitable to producers than the fillet. Producers must find ways to add value to the fillet; or they must reduce costs to capture the same level of profit.

## Physical Assembly and Distribution of Sunshine Bass

The physical distribution analysis was separated into fish assembly and processed product distribution. The assembly method for Sunshine Bass consisted of hauling raw fish from the location of harvest to a processing plant. The product distribution consisted of hauling the packed product from the processing plant to four retail stores. Processing at or closer to the growing-site will create greater efficiency. Sunshine Bass was hauled to a marine seafood processor for two reasons. First, the harvest site lacked qualified fish cutters. Second, researchers wanted to determine the shrinkage rates of Sunshine Bass based on packing methods.

The physical distribution of Sunshine Bass consisted of two test periods, October 15 to 27, 1990 and March 18 to 23, 1991, which preceded the consumer acceptance testing periods. Two delivery vehicles were used in the study. One was a 20-foot, refrigerated, straight-body truck with rear- and side-access doors, an insulated body, and a thermo-king refrigeration unit. The other was a 9-foot van with an insulated storage compartment. During the study, neither vehicle was loaded to near capacity. The estimated hauling weights for the trucks fully loaded were 12,500 pounds for the 20-foot truck and 800 pounds for the van. The cost of inputs for the assembly and distribution included trucks, fuel, driver, and packaging for fish (See Table 11).

The physical distribution analysis consisted of collecting transportation data on the same delivery itinerary for each test period during the study. The transportation data were summarized by spreadsheet calculations. Time and mileage values for assembly and distribution delivery were estimated. The results of these calculations allowed certain assumptions to be made about estimated costs for future routing. The physical data analysis consisted of calculating the route mileage for assembly and distribution of the fish, and return of the truck and driver.

The assembly process consisted of delivering the whole fish from Virginia Tech's aquaculture facility at Blacksburg, Virginia, to a processing site in Hampton, Virginia. If commercial producers have approved processing facilities, Sunshine Bass can be processed at the growing site. That will reduce the cost of product assembly. The assembly data show the total and unit or per-pound cost involved in growing and assembling products harvested at a central processing plant. This information is valuable for the producer who may grow fish, but does not have access to processing facilities.

A triangle route illustrates the truck movement during the physical distribution process: assembly, distribution, and return to base. In the geographic description, the transportation route consisted of three legs: aquaculture facility to processing plant, processing plant to Graul Markets, and Graul Markets to aquaculture location. Each leg consisted of data on mileage, transit time, and delays in transit. The in-transit delay-time includes refueling, meals, and loading and unloading the Sunshine Bass in their various forms.

**Table 11. Physical Assembly of Sunshine Bass by Week, 1990-1991**

Blacksburg to Hampton, Va. Weekly Trip:	Mileage	Travel (hours)	Breaks
WEEK 1, October 15, 1990	295.00	6.47	1.22
WEEK 2, October 22, 1990	315.00	5.55	.98
WEEK 3, March 18, 1991	309.00	5.75	.00
AVERAGE	306.33	5.92	.73

### Assembly of Sunshine Bass

The data showed that the average assembly route length based on three trips measured 306 miles from the Virginia Tech aquaculture facility to the seafood processing plant location (See Table 11). For a trip, the average travel time was 5.92 hours with 0.73 hours of break-time for fuel and meals. Researchers calculated cost estimates for product assembly weekly by route. The cost estimates in Tables 11.1, 11.2, and 11.3 come from the economic data in Figure 3.

The total costs involved in product assembly included (a) truck usage, mileage, fuel, refrigeration operation, and estimated driver expenses, and (b) hourly rate for the driver and his overnight expenses. The costs for Sunshine Bass assembly varied slightly by week of delivery and significantly by truck size.

*Assembly cost for market test, week one.* For product assembly, the total costs, unit or per-pound costs for the research load, and unit costs for a truck loaded to capacity amounted to \$268.06, \$0.41, and \$.02, respectively (Table 11.1).

*Assembly cost for market test, week two.* For product assembly, the total costs, unit costs for the research load, and unit costs for a truck loaded to

capacity amounted to \$259.84, \$0.90, and \$.02, respectively (Table 11.2).

*Assembly cost for market test, week three.* The costs for Sunshine Bass assembly for week three differed from those for weeks one and two because of the van body-type of truck used and the product weight (800 pounds) hauled in the vehicle. For product assembly, the total costs, unit costs for the research loading, and unit costs for the capacity load amounted to \$161.11, \$0.46, and \$.20, respectively (Table 11.3).

**Table 11.1. Total and Unit Assembly Cost, Week One, 1990**

BLACKSBURG TO HAMPTON, VA	-EXPENSES-	RESEARCH LOAD	CAPACITY LOAD
WEEK 1, OCTOBER 15, 1990	-\$-	\$/LB	\$/LB
COST ITEM			
TRUCK COST			
DAY RATE	65.00	.10	.01
MILEAGE	35.40	.05	.00
FUEL	57.19	.09	.00
THERMO-KING	2.85	.00	.00
DRIVER COST	107.62	.17	.01
TOTAL AND UNIT COST	268.06	.41	.02

**Table 11.2. Total and Unit Assembly Cost, Week Two, 1990**

BLACKSBURG TO HAMPTON, VA	-EXPENSES-	RESEARCH LOAD	CAPACITY LOAD
WEEK 2, OCTOBER 22, 1990	-\$-	\$/LB	\$/LB
COST ITEM			
TRUCK COST			
DAY RATE	65.00	.23	.01
MILEAGE	37.80	.13	.00
FUEL	61.07	.21	.00
THERMO-KING	2.85	.01	.00
DRIVER COST	93.13	.32	.01
TOTAL AND UNIT COST	259.84	.90	.02

**Table 11.3. Total and unit assembly cost, week three, 1991**

BLACKSBURG TO HAMPTON, VA	-EXPENSES-	RESEARCH LOAD	CAPACITY LOAD
WEEK 3, MARCH 18, 1991	-\$-	\$/LB	\$/LB
COST ITEM			
TRUCK COST			
DAY RATE	.00	.00	.00
MILEAGE	67.98	.19	.08
FUEL	.00	.00	.00
THERMO-KING	.00	.00	.00
DRIVER COST	93.13	.26	.12
TOTAL AND UNIT COST	161.11	.46	.20

The difference in total assembly costs from week one to week two was about \$8.22 (Tables 11.1 and 11.2). However, the difference in weight for the two loads more than doubled the unit cost (in dollars per pound) from week one to week two because the load was lighter in week two (Tables 11.1 and 11.2). The unit cost (\$/lb) would have dropped to about \$0.02 per pound if the vehicle had been loaded to capacity (Tables 11.1 and 11.2).

A capacity load for the 20-ft truck would be 12.5 pallets, each containing 25 fish boxes, and each box holding 40 lb. of fish and 12 lb. of ice, for a total capacity load of 12,500 lb. of fish plus ice. For the 9-ft. van, a capacity load would be 20 fish boxes, each containing 40 lb. of fish and 12 lb. of ice, for a total load of 800 lb. of fish plus ice. The trucks could hold more total weight than these "capacity" loads, but the quality of the fish arriving at the market might be compromised.

The value of the cost information for product assembly shows an aquaculture producer the prospective unit cost of delivering harvested Sunshine Bass to an off-premises processing service.



## **Conclusions**

1. Given regulations, moving Sunshine Bass to a processing plant is essential if certified processing facilities are not located on-site of a growing-harvest facility.
2. The weight of the fish hauled impacts costs. Small changes in pounds loaded can alter the costs dramatically. Full loads sharply reduce the cost of product assembly.
3. Given the value of assembly costs, if a producer can process Sunshine Bass at the harvest location, the benefits include reducing costs for assembly, adding at least one day to shelf-life, and eliminating waste products in the market.
4. Given the geographical space of the study, an aquacultural marketer can haul Sunshine Bass to a processing plant within a three-hundred-mile radius for a unit cost of about \$0.20 per pound for a 9-foot van and for a unit cost of about \$0.02 per pound for a 20-foot vehicle.

## **Distribution of Sunshine Bass**

Sunshine Bass was distributed from the L.D. Amory seafood processing plant to four Graul Markets in the Baltimore, Maryland area. Distribution data show the route averaged about 300 miles from processing plant to the four retail stores (Table 12). On the distribution route, an average time of 7.67 hours time was spent in-transit plus 1.97 hours for break-time, or a total time of 9.64 hours. Break-time consisted of refueling and meals (Table 12). For similar mileage data, the product distribution time increased, when compared to the time for product assembly, because of increased traffic congestion in the metropolitan area and delivery delays.

### **Product distribution cost, week one**

After the fish were processed, the trucks hauled smaller gross weights of Sunshine Bass to the retail markets than were hauled to the processing plants because of shrinkage caused by processing. For week one, product distribution costs totaled \$259.33, for a per-pound cost of \$0.40. If the vehicle had been loaded to capacity, the estimated per-pound cost would have dropped to \$0.02 (Table 12.1).

### **Product distribution cost, week two**

For week two, the total cost and the per-pound cost for the research-size load were calculated to be \$265.82 and \$0.92, respectively. The per-pound cost estimate for a capacity-size load was \$.02 for week two (Table 12.2).

### **Product distribution cost, week three**

The product distribution cost for week three differed from those for weeks one and two because of the size of the vehicle used and because of the difference in weight of product being transported. For week three, total costs were \$178.50, per-pound costs \$0.51. The estimated per-pound cost for a truck loaded to capacity is \$0.22 (Table 12.3).

## **Analyzing the physical distribution process and costs for Sunshine Bass**

The Sunshine Bass analysis consisted of defining two "pay-load" legs and one "empty" leg in a geographical route triangle. During weeks one and two, total distribution mileage amounted to an average of 909 miles per week. The three-legged route required 21.24 driver-travel

**Table 12. Delivery to retail store, weekly, 1990-1991**

WEEKLY DELIVERY FUNCTION	MILEAGE	TIME (HOURS)	TIME (HOURS)
<b>WEEK 1, OCTOBER 17, 1990</b>			
HAMPTON TO HEREFORD, MD	222.00	5.48	.00
MEAL	.00	.00	.57
HEREFORD TO RUXTON, MD	17.00	.47	.45
RUXTON TO CAPE ST. CLAIRE, MD	53.00	1.68	.43
MEAL	.00	.00	.93
CAPE ST. CLAIRE TO ANNAPOLIS, MD	7.00	.25	.48
<b>WEEK ONE--SUBTOTAL</b>	<b>299.00</b>	<b>7.88</b>	<b>2.87</b>
<b>WEEK 2, OCTOBER 24, 1990</b>			
HAMPTON TO HEREFORD, MD	213.00	5.28	.00
MEAL	.00	.00	.38
HEREFORD TO RUXTON, MD	15.00	.33	.50
RUXTON TO CAPE ST. CLAIRE, MD	64.00	2.37	.40
MEAL	.00	.00	.00
CAPE ST. CLAIRE TO ANNAPOLIS, MD	6.00	.30	.38
<b>WEEK TWO--SUBTOTAL</b>	<b>298.00</b>	<b>8.28</b>	<b>1.67</b>
<b>WEEK 3, MARCH 18, 1991</b>			
HAMPTON TO HEREFORD, MD	224.00	4.50	.00
MEAL	.00	.00	.55
HEREFORD TO RUXTON, MD	16.00	.45	.22
RUXTON TO CAPE ST. CLAIRE, MD	57.00	1.22	.30
MEAL	.00	*	.00
CAPE ST. CLAIRE TO ANNAPOLIS, MD	7.00	.68	.30
<b>WEEK THREE--SUBTOTAL</b>	<b>304.00</b>	<b>6.85</b>	<b>1.37</b>
AVERAGE TRAVEL (3 WEEKS)	300.33	7.67	1.97
RETURN TO BLACKSBURG	303.00	7.65	2.00

\* Included meal intransit.

hours and 4.70 break-time hours, or a total time of 25.94 hours (Table 13). For weeks one and two, the average total cost was \$791.74. For the same period, the unit cost was \$0.44 per pound.

On these trip loads, the truck hauled a total of 1783.8 pounds of product (Figure 3) that resulted in the unit cost basis noted in Table 13.1. The vehicle returned to Blacksburg empty. The charge for the empty leg was added to the cost of the Sunshine Bass hauled in the assembly and distribution segments. If the 20-foot truck had been loaded to capacity, the unit cost estimate would have resulted in about a \$0.06 per pound charge for assembly and distribution.

**Table 12.1. Total and unit cost of distribution, week one, 1990**

HAMPTON TO BALTIMORE, MD	-EXPENSES-	RESEARCH LOAD	CAPACITY LOAD
WEEK 1, OCTOBER 17, 1990	-\$-	\$/LB	\$/LB
COST ITEM			
TRUCK COST			
DAY RATE	65.00	.10	.01
MILEAGE	35.88	.06	.00
FUEL	57.97	.09	.00
THERMO-KING	2.85	.00	.00
ICE	6.51	.01	.00
DRIVER COST	91.12	.14	.01
TOTAL AND UNIT COST	259.33	.40	.02
RETURN TO BLACKSBURG, VA	232.48	EMPTY	EMPTY

**Table 12.2. Total and unit cost of distribution, week two, 1990**

HAMPTON TO BALTIMORE, MD	-EXPENSES-	RESEARCH LOAD	CAPACITY LOAD
WEEK 2, OCTOBER 24, 1990	-\$0	\$/LB	\$/LB
COST ITEM			
TRUCK COST			
DAY RATE	65.00	.23	.01
MILEAGE	25.56	.09	.00
FUEL	41.29	.14	.00
THERMO-KING	2.85	.01	.00
ICE	2.89	.01	.00
DRIVER COST	124.61	.43	.01
TOTAL AND UNIT COST	262.20	.91	.02
RETURN TO BLACKSBURG	232.48	EMPTY	EMPTY

**Table 12.3. Total and unit cost of distribution, week three, 1991**

HAMPTON TO BALTIMORE, MD	-EXPENSES-	RESEARCH LOAD	CAPACITY LOAD
WEEK 3, MARCH 20, 1991	-\$-	\$/LB	\$/LB
COST ITEM			
TRUCK COST			
DAY RATE	.00	.00	.00
MILEAGE	66.88	.19	.08
FUEL	.00	.00	.00
THERMO-KING	.00	.00	.00
ICE			
PLASTIC CONTAINER			
DRIVER COST	111.62	.32	.14
TOTAL AND UNIT COST	178.50	.51	.22
RETURN TO BLACKSBURG, VA	139.04	EMPTY	EMPTY

**Table 13. Physical distribution routes for three weeks, 1990-1991**

ROUTE FUNCTION	MILEAGE	TIME (HOURS)	
		TRAVEL	BREAKS
ASSEMBLY	306.33	5.92	.73
DISTRIBUTION	300.33	7.67	1.97
RETURN TO BLACKSBURG	303.00	7.65	2.00
TOTAL AVERAGE UNITS	909.67	21.24	4.70

1 No shrinkage factor included.

The same geographical legs were traveled by the 9-foot cargo van for the third week. Total costs for the third week amounted to \$478.64, resulting in a unit cost of \$1.10 per pound (Table 13.2). For the three route-legs, the truck traveled 909.66 miles and hauled 434.7 pounds of product (Figure 3). If the 9-foot van had been loaded to its capacity, the estimated unit cost would be \$0.60 (Table 13.2).

**Table 13.1. Physical distribution routes for two weeks, 1990**

ROUTE FUNCTION	-EXPENSES-	RESEARCH LOAD	CAPACITY LOAD
COST ITEM	-\$-	\$/LB	\$/LB
ASSEMBLY	260.77	.28	.02
DISTRIBUTION	298.50	.32	.02
RETURN TO BASE	232.48	EMPTY	EMPTY
TOTAL AND UNIT COST	791.74	.44	.06

No shrinkage factor included.

**Table 13.2. Physical distribution route for week three, 1991**

ROUTE FUNCTION	-EXPENSES-	RESEARCH LOAD	CAPACITY LOAD
COST ITEM	-\$-	\$/LB	\$/LB
ASSEMBLY	161.11	.46	.20
DISTRIBUTION	178.50	2.15	.22
RETURN TO BASE	139.04	EMPTY	EMPTY
TOTAL AND UNIT COST	478.64	1.10	.60

No shrinkage factor included.

## Conclusions

1. The weight of the processed fish hauled impacts costs. Small changes in pounds loaded can affect the costs dramatically. Full loads sharply reduce the cost of products hauled.
2. Given the geographical space of the study, the cost for a 900-mile triangular route including assembly, distribution, and return will amount to about \$0.06 cents per pound for a 20-foot refrigerated truck. For the same routing, the costs amount to about \$0.60 cents per pound for a 9-foot non-refrigerated van.
3. Under normal conditions, distribution to retail stores would take place through a wholesaler or distributor. A cost savings could be realized by adopting this strategy.

## Product Temperature In-transit

Maintaining tissue temperatures between 32 degrees and 34 degrees Fahrenheit is essential to maintaining high quality fish products and prolonging shelf-life. This research examined ways to assure the target temperatures were maintained. By using a refrigerated truck, and applying ice on or near the product tissue of the Sunshine Bass, desired product temperatures were maintained during transit. Product temperatures were monitored by two Grant Squirrel Meter/Logger (8 bit, 4 channel) with six thermocouples (Type T, Copper/Constantan).

The handling procedures maintained product temperature in all three weeks of test shipments at 33.2 degrees Fahrenheit. In week one, product tissue temperatures ranged from 32.4 to 34.8 degrees Fahrenheit. In week two, product tissue temperatures ranged from 32.4 to 41.2 degrees Fahrenheit. In week three, product temperatures ranged from 32.4 to 34.8 degrees Fahrenheit (Anthony and Craig, pages 1-2). Ambient air temperature was measured during all three weeks of test shipments. The temperatures for week one ranged from 27.6 to 51.6 degrees Fahrenheit, for week two from 26.0 to 50.0 degrees Fahrenheit, and for week three from 40.3 to 74.8 degrees Fahrenheit (Anthony and Craig, page 10).

The cargo space in the truck used during weeks one and two was refrigerated by a cooling unit that operated periodically by thermostatic control. In addition, ice packed in the fish box insulated and cooled the fish. The Sunshine Bass was stored overnight in the cargo space of the refrigerated truck before being processed at the L.D. Amory Company.

During week three, a 9-foot van hauled Sunshine Bass to the processing and marketing sites. An insulated space was created for cooling Sunshine Bass. The floor of the van was covered with a one-inch Styrofoam panel and with polyvinyl 6-mil plastic sheeting. Ice was placed in waxed fish boxes to create a cooled environment for maintaining the temperature levels on the Sunshine Bass. A non-mechanical refrigerator was created by completely surrounding the product in a bed or cave of ice. The proper in-transit temperature for Sunshine Bass was maintained with the "artificial" refrigerator and ice surrounding the product.

## **Processing of Sunshine Bass**

Fish processing operations add value to aquaculture products by changing their market forms, adding services, and creating new consumer uses. The Sunshine Bass study offered customers two product forms: whole-gutted and fillet. The employees at the fish plant transformed Sunshine Bass into whole-gutted and fillet-product forms during the study. In the Graul Markets, two different Sunshine Bass product forms were offered: (1) whole-gutted, with skin- and head-on, and (2) fillets with skin off. The data collected during processing showed yield and value of the two product forms.

### **Processing methods, weeks one and two**

After arriving at the processing plant on Monday, the truck loaded with fish was parked. The truck cooling unit operated as required to maintain the predetermined fish-tissue temperature. At 8:00 a.m. on Tuesday, all the fish boxes were unloaded from the truck, placed on pallets, and moved to a temporary storage area near the fish processing room.

A weighing procedure for the fish was established. The ice and fish in each box were dumped into a waterbath so that the whole fish could be separated from the ice. The Sunshine Bass were then placed in a cardboard container, the net weight of the entire box of fish was recorded, and the whole Sunshine Bass were moved to the fish processing room.

In the processing room, skilled fish cutters removed the viscera of the larger Sunshine Bass. These gutted Sunshine Bass were moved back to the packing room. The fish were weighed, packed into a bed of ice, and placed in a waxed shipping carton. The Sunshine Bass were labeled according to permit regulations, and the boxes of fish were placed on a pallet for loading on the delivery truck.

Fish cutters filleted the smaller-sized Sunshine Bass. These fillets were returned to the packing room, where they were weighed, their weight was recorded, and they were returned to the cutting room for skinning. The skinned Sunshine Bass fillets were returned to the packing room for weighing, packing in ice, labeling, and assignment to a Graul market. The fish boxes were stored on pallets before being loaded on the truck.

### **Muscle food utilization, week one**

A sample of 100 Sunshine Bass was chosen at random and weighed during each week of harvest. During week one, the larger of the Sun-



**Table 14. Processing Sunshine Bass, whole-gutted, Week one, Oct. 16, 1990**

Trial Number	one	two	three	four	five	average
			<i>pounds</i>			
Weight whole fish	39.90	40.10	40.60	41.40	40.80	40.56
Weight whole fish/after trans.	38.80	39.20	39.60	40.00	40.20	39.56
Weight of gutted fish	36.70	36.10	36.60	36.90	37.30	36.72
Recovery percent	91.98	90.02	90.15	89.13	91.42	90.53

**Table 14.1. Processing Sunshine Bass, fillet, Week one, October 16, 1990**

Trial Number	one	two	three	four	five	average
			<i>pounds</i>			
Weight whole fish	40.80	39.50	40.10	39.90	40.10	40.08
Weight whole fish/after trans.	39.80	39.00	39.20	39.20	39.40	39.32
Weight fillet/skin-on	17.40	15.60	17.20	16.40	17.20	16.76
Weight fillet/skin-off	9.50	9.40	9.20	9.80	9.00	9.38
			<i>percent</i>			
Weight of fish/skin-on	42.65	39.49	42.89	41.10	42.89	41.81
Weight of fish/skin-off	23.28	23.80	22.94	24.56	22.44	23.41

Trial number equaled one box of sunshine bass weighing about 40 pounds

shine Bass harvested weighed on average 0.786 pounds. The smaller Sunshine Bass weighed on the average about 0.55 pounds. The larger Sunshine Bass were gutted and designated for sale in the Graul markets.

The larger of the Sunshine Bass had lost on average about 2.45 percent of their weight after having been transported 300 miles (Table 14). During this period, the marketing strategy called for marketing the carcass with fish-heads and fins. Each lot of Sunshine Bass was re-weighed after the fish processors had gutted the fish. A sample of those fish studied showed that Sunshine Bass retained about 90.53 percent of their original body weight after transport (Table 14). The shrink associated with the assembly transportation process amounted to about 9.5 percent.

During week one, the smaller size Sunshine Bass were filleted and skinned for consumer tasting. A sample of the smaller Sunshine Bass showed they averaged about 1.9 percent of weight loss during transport (Table 14.1). With skin on, a sample of Sunshine Bass showed that fillets averaged 41.8 percent of their harvest weight (Table 14.1). With the skin-off, the fillets weighed 23.4 percent of their harvest weight (Table 14.1). The shrinkage associated with these processes was about 58.19 percent for fillets with skin-on and about 76.59 percent for fillets with skin-off.

### **Muscle food utilization, week two**

In week two, the larger of the Sunshine Bass harvested weighed on average about 0.89 pounds. The smaller Sunshine Bass weighed on the average about 0.58 pounds. The fish processors gutted the larger Sunshine Bass, which were designated for sale in the Graul markets.

A sample of the larger of the Sunshine Bass showed they lost an average of 1.97 percent of their harvest weight during the assembly process (Table 14.2). The Sunshine Bass were gutted and then reweighed. A sample of smaller Sunshine Bass showed that they retained 90.80 percent of their harvest weight. The shrink associated with the assembly process amounted to about 9.20 percent. The larger Sunshine Bass were gutted, packed, and shipped to Graul Markets.

### **Processing methods, week three**

After arriving at the processing plant, the Sunshine Bass were unloaded, placed on pallets, and moved into a pre-cooled storage room. At 8:00 a.m. on Tuesday, the Sunshine Bass were moved to a receiving area near the fish-processing room.

The same weighing procedure was used as that described for weeks one and two. The smaller Sunshine Bass had about the same yield in week three as in week two. The fish weighed 3 percent less after transit

to the processing plant (Table 14.3). The weight of the Sunshine Bass after filleting amounted to 42.11 percent with skin-on and 22.92 with skin off (Table 14.3).

### **Muscle food utilization, week three**

In week three, the largest of the fish harvested weighed on average about 0.96 pounds. A sample of Sunshine Bass showed a 5.0 percent weight loss after the assembly process (Table 14.4). The fish processors filleted the Sunshine Bass, and the fish were reweighed. The sample showed that the Sunshine Bass retained about 22.15 percent of their harvest weight. The shrink associated with filleting amounted to about 77.85 percent of the harvest weight.

### **Processing costs**

Processing Sunshine Bass into a different market form improves the market appeal of the product, increases the value of the product, and also increases the cost of the new market form. (A time and motion study was not conducted on the processing operations involved with the marketing research.) The L.D. Amory Co. provided processing services. The company charged a predetermined variable cost rate to cover their costs for the fish processed.

The processing cost was calculated for preparing the Sunshine Bass for retail marketing. The factor inputs that generated costs for processing included the processing of fish and waxed containers for shipping ice and, for the fillets, a plastic container to protect fillet quality. For the small volume of fish in the study, the cost incurred for gutting and packing whole fish amounted to \$0.42 per pound (Table 14.6). The total processing costs for fillets amounted to about \$1.89 per pound (Table 14.6). By reducing processing costs, the Sunshine Bass fillet pack may cost less. In estimating the cost for a commercial processing operation, the processing costs for whole-gutted Sunshine Bass would be \$0.33 per pound, for the fillet product form \$1.52.

### **Cost control and margin problems**

During weeks one and two, three cost-factors were estimated on a unit-cost (per-pound) basis. Costs were estimated for assembly, processing, and distribution (Table 15). On a commercial scale, estimated product assembly costs were \$0.02 per pound. For the research quantities, processing costs amounted to \$0.37 per pound.

Total retail store distribution costs amounted to about \$0.02, and an empty back-haul added \$0.19 per pound. On a unit cost basis, the total

**Table 14.2. Processing Sunshine Bass, whole-gutted, Week two, Oct. 23, 1990**

trial Number	one	two	three <i>pounds</i>	four	five	average
Weight whole fish	40.60	40.60	40.10	40.60	40.30	40.44
Weight whole fish/after trans.	39.60	39.60	39.40	40.00	39.60	39.64
Weight of gutted fish	36.20	37.40	36.40	37.00	36.60	36.72
			<i>percent</i>			
Recovery	89.16	92.12	90.77	91.13	90.82	90.80

Trial number equaled one box of sunshine bass weighing about 40 pounds.

**Table 14.3. Processing Sunshine Bass, fillet, Week two, Oct. 23, 1990**

Trial Number	one	two	three <i>pounds</i>	four	five	average
Weight whole fish	40.30	41.90	40.80	40.30	39.90	40.64
Weight whole fish/after trans.	38.80	41.00	39.00	39.40	38.80	39.40
Weight fillet/skin-on	16.00	18.20	17.40	17.80	16.20	17.12
Weight fillet/skin-off	9.40	10.00	9.80	8.40	9.00	9.32
			<i>percent</i>			
Weight fillet/skin-on	39.70	43.44	42.65	44.17	40.60	42.11
Weight fillet/skin-off	23.33	23.87	24.02	20.84	22.56	22.92

Trial number equaled one box of sunshine bass weighing about 40 pounds.

**Table 14.4. Processing Sunshine Bass, fillet, Week three, March 19, 1991**

Trial Number:	one	two	three	four	five
	<i>pounds</i>				
Weight whole fish	45.40	43.80	46.20	45.60	46.40
Weight whole fish/after transport	43.10	41.50	43.90	43.30	44.10
Weight fillet/skin off	10.30	10.10	10.70	10.30	10.10
	<i>percent</i>				
Weight of fish/skin off	22.69	23.06	23.16	22.59	21.77

Trial number equaled one box of sunshine bass weighing about 40 pounds.

**Table 14.5. Processing Sunshine Bass, fillet (continued), March 19, 1991**

Trial Number	one/five	six	seven	eight	average
	<i>pounds</i>				
Weight whole fish	227.40	46.00	45.80	45.60	45.60
Weight whole fish/after trans.	215.90	43.70	43.50	43.30	43.30
Weight fillet/skin-off	51.50	10.90	10.50	10.30	10.10
	<i>percent</i>				
Weight fillet/skin-off	22.65	23.70	22.93	22.59	22.15

Trial number equaled one box of sunshine bass weighing about 40 pounds.

**Table 14.6. Research cost for processing Sunshine Bass, by week, 1990-1991**

Cost:	Week 1		Week 2		Week 3	
	total	unit	total	unit	total	unit
Cost items:						
Labor	195.30	.33	86.58	.33	105.45	1.27
Shipping box	19.76	.03	8.75	.08	79.06	.24
Ice	29.28	.05	12.96	.11	16.64	.35
Plastic container	---	---	---	---	10.55	.03
Total and unit cost	244.34	.42	108.29	.42	211.69	1.89

**Table 14.7. Estimated commercial cost for processing Sunshine Bass, 1990-1991.**

Cost	Week 1		Week 2		Week 3	
	total	unit	total	unit	total	unit
Cost items:						
Labor	3750.00	.30	3750.00	.30	240.00	1.27
Shipping box	379.49	.03	378.90	.03	14.03	.07
Ice	56.22	.00	56.13	.00	1.69	.07
Plastic container	---	----	---	---	18194	.10
Total and unit cost	4185.71	.33	4185.03	.33	274.65	1.52

marketing costs for the Sunshine Bass amounted to about \$0.60 per pound, which left about \$2.90 to cover channel costs and profit, and producer costs and profit. With the whole-gutted product, Sunshine Bass lost about 10 percent of its body weight. At a price level of \$3.73 and a 90-percent yield, the Sunshine Bass gutted form at the producer level is worth \$3.03 (See Figure 1). In a fillet form, the Sunshine Bass is worth about \$1.56 per pound, or much less than the whole-gutted form, yet this is the form the customers seem to prefer.

Trial number equaled one box of Sunshine Bass weighing about 40 pounds.

## Conclusions

1. Based on product utilization, two factors influenced the Sunshine Bass product value: its yield and its size.

*Factor one*, tissue yield, was about 42 percent with the skin-on and about 23.5 percent with the skin-off, which created a high-cost product when compared to wild-caught rockfish.

*Factor two*, the size-weight of the Sunshine Bass varied from about 1.1 pounds to about 0.5 pounds. This reduction in size for Sunshine Bass also reduced its value when compared to the larger, wild-caught rockfish.

2. Based on product packaging observations and a 300-mile delivery destination, the test shipment in week three showed that a refrigerated vehicle may not be needed if the product is properly iced and insulated to prevent product quality loss.

**Table 15. Summary of cost for marketing Sunshine Bass, 1990**  
Commodity is whole gutted Sunshine Bass

Cost Items:	RES, Weeks	COMM, Weeks
	1 and 2	1 and 2
	(dollars)	
Retail target price	\$5.99	\$5.99
Cost from processing	3.73	3.73
Physical distribution	.44	.06
Processing	.42	.33
Physical distribution cost	2.87	3.33

RES = Research; COMM = Commercial loading factor.  
Target price based on gross margin of 37.75.

**Table 15.1. Summary of cost for marketing Sunshine Bass, 1991**  
Commodity is filleted, skin-off Sunshine Bass

Cost Items:	RES, Week 3	COMM, Week 3
	(dollars)	
Retail target price	\$8.99	\$8.99
Cost from processing	5.60	5.60
Physical distribution	1.10	.60
Processing	1.89	1.52
Physical distribution cost	2.61	3.48

RES = Research; COMM = Commercial loading factor.  
Target price based on gross margin of 37.75.



## Sensory Evaluation and Shelf Life

Sunshine Bass grown in the Virginia Tech recirculating aquaculture system were used for the sensory evaluation. When harvested, these Sunshine Bass were placed in an ice water bath, packed in standard fifty-pound fish containers with ice on the fish (bottom and top), and stored at 32 degrees Fahrenheit. Fish processors filleted all Sunshine Bass within 24 hours of harvest. The Sunshine Bass were washed, packed in sterile Whirl Bags, and refrigerated in three-temperature environments:

1. Packed in crushed ice at 32 degrees Fahrenheit.
2. Placed in a temperature-controlled environment at 29 degrees Fahrenheit.
3. Placed in a temperature-controlled environment at 36 degrees Fahrenheit.

In order to rapidly chill the fillets to 29 degrees Fahrenheit, fillets were placed in a monolayer on the refrigerator racks. After the fillets reached 29 degrees, they were placed in a master carton for the remainder of the storage period.

Three temperatures were chosen to represent recommended or normally used packing methods. Crushed ice is the customary packing method for most finfish and shellfish products. The samples held at 36 degrees represent the approximate average product temperature experienced during repacking, distribution, retailing, and home refrigerator storage. A recently recommended storage temperature of 29 degrees is known as "superchilling." This cooling procedure allows fish to obtain a light crust of surface ice without the meat's being frozen. The meat will freeze, however, if the temperature is lowered below 29 degrees Fahrenheit. Superchilling has been successfully used in the poultry industry to maintain high quality while also extending product shelf life.

Fish samples were drawn for sensory analysis after 3, 8, 10, 13, 15, 17, and 20 days of storage. An experienced sensory panel of 15 people evaluated raw fillets for appearance, odor, and texture. The fillets were wrapped individually in aluminum foil and baked for 15 minutes at 350 degrees Fahrenheit. Panelists were instructed to provide a rating for each fish sample. The taste panelists rated the Sunshine Bass on a 9-point hedonic scale (See Figure 4). If a panelist judged the fish sample unacceptable, he or she didn't rate it. When more than half the panelists rated

a fish sample unacceptable, the sample was withdrawn from further evaluation.

When freshly harvested Sunshine Bass fillets had been stored at 29 degrees Fahrenheit, taste panelists found them acceptable according to the predetermined criteria (See Figures 5 to 11). Those fillets stored at 32 degrees Fahrenheit had an acceptable shelf life of 15 days. Taste panel members judged Sunshine Bass fillets stored at 36 degrees Fahrenheit to be unacceptable after 10 days in storage.

A microbiological evaluation was conducted concurrently with the sensory analysis. The total aerobic plate count was evaluated by swabbing a one-square-inch surface and counting the organisms on Nutrient Agar. The initial microbial population grew to  $4.0 \times 10^2$ . Within 13 days of storage, microbial counts expanded to  $5.0 \times 10^4$ ,  $4.0 \times 10^7$ , and  $7.0 \times 10^5$  for the 36, 32, and 29 degree Fahrenheit stored samples, respectively (Figure 12). By the 15th day of storage, the microbial counts on 32 degree Fahrenheit samples grew to  $10^7$ ; on the 20th day, the counts of the 29 degree Fahrenheit samples stabilized at  $10^5$ .

Temperature had a substantial effect on surface microbial growth. The difference between 29 and 36 degrees Fahrenheit, or 7 Fahrenheit degrees, resulted in a 4 log difference in microbial population growth. The ability to store Sunshine Bass either whole or as fillets at 29 degrees Fahrenheit will provide a significant shelf-life extension and maintain the product in a high quality state. The adoption of a policy on storage at 29 degrees Fahrenheit by retail market outlets will reduce discards and drip loss and product discounting, and enable the consumer to hold the product for several days in the home refrigerator before a significant decrease in quality is perceived.

Given the sensory evaluation results and the relationship that has been determined between temperature and product shelf life, product temperatures must be held as close to 29 to 32 degrees Fahrenheit as possible to maintain a longer product shelf-life. These temperature conditions hold for raw or cooked products. Temperatures above 36 degrees Fahrenheit drastically reduce shelf life.

Figure 5  
Raw Striped Bass Appearance

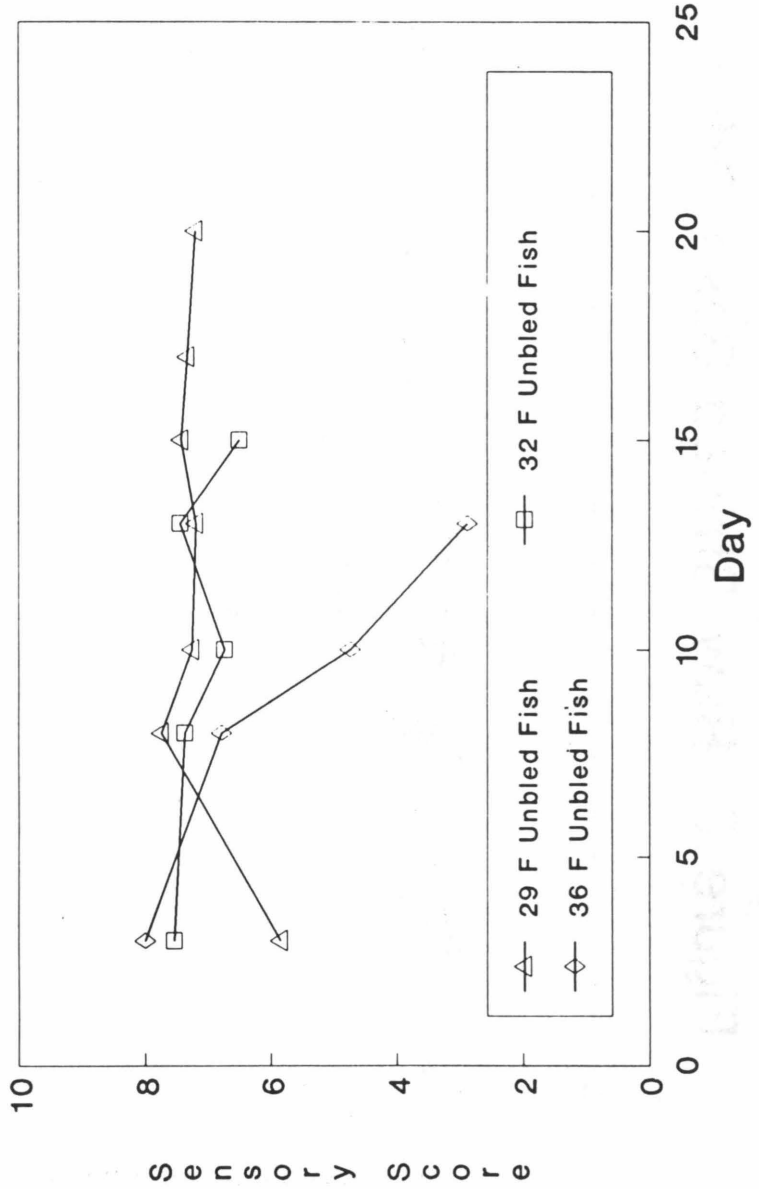


Figure 6 Raw Striped Bass Odor

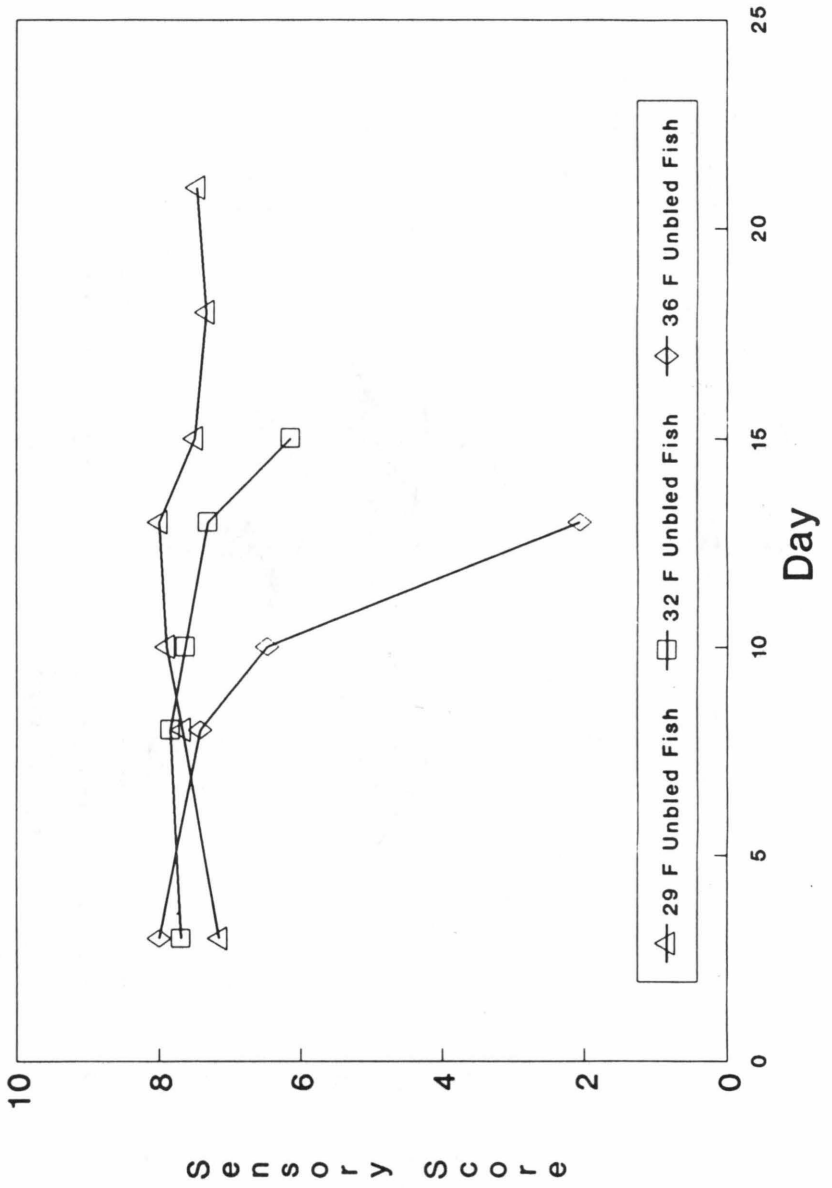


Figure 7 Raw Striped Bass Texture

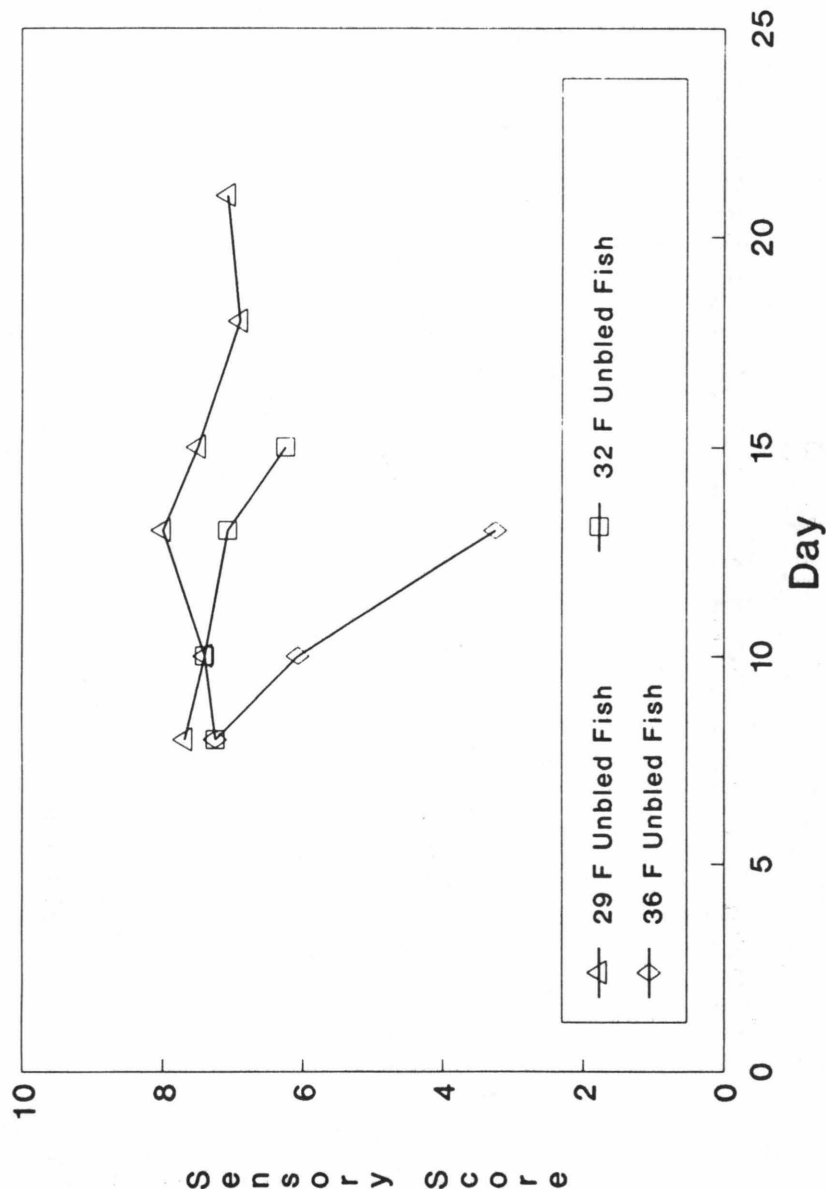


Figure 8  
Cooked Striped Bass Appearance

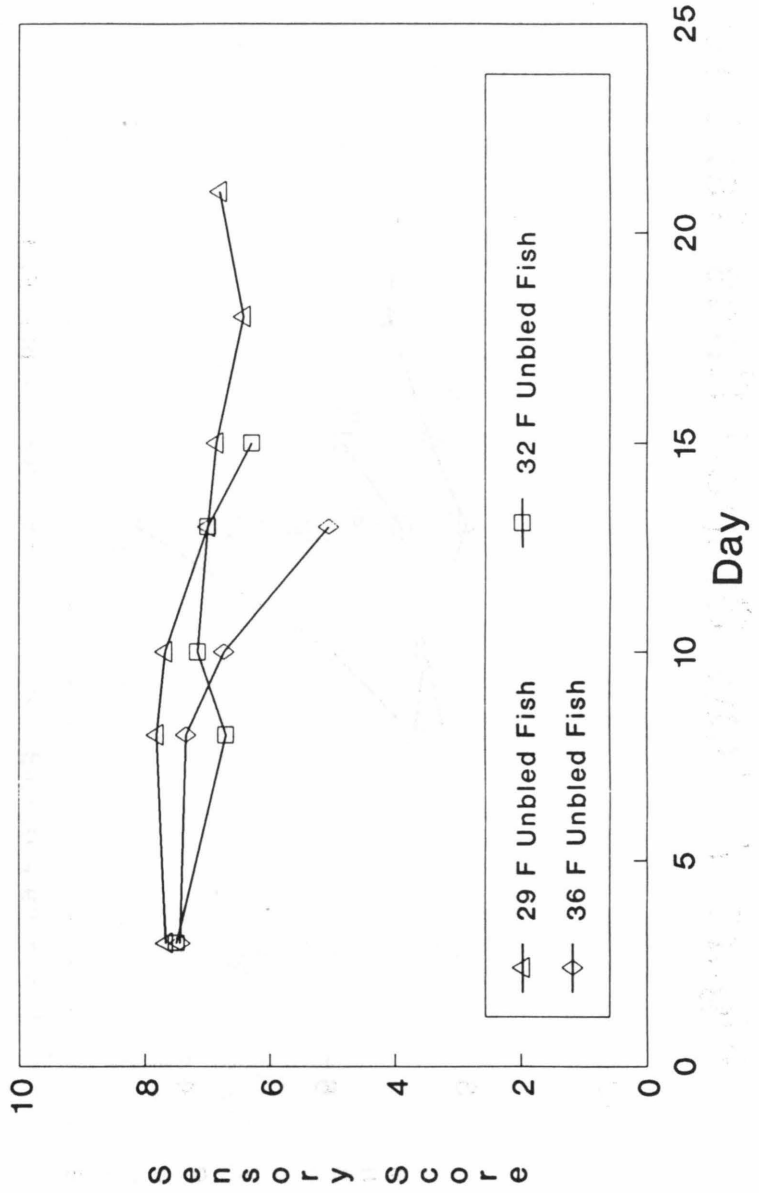


Figure 9  
Cooked Striped Bass Odor

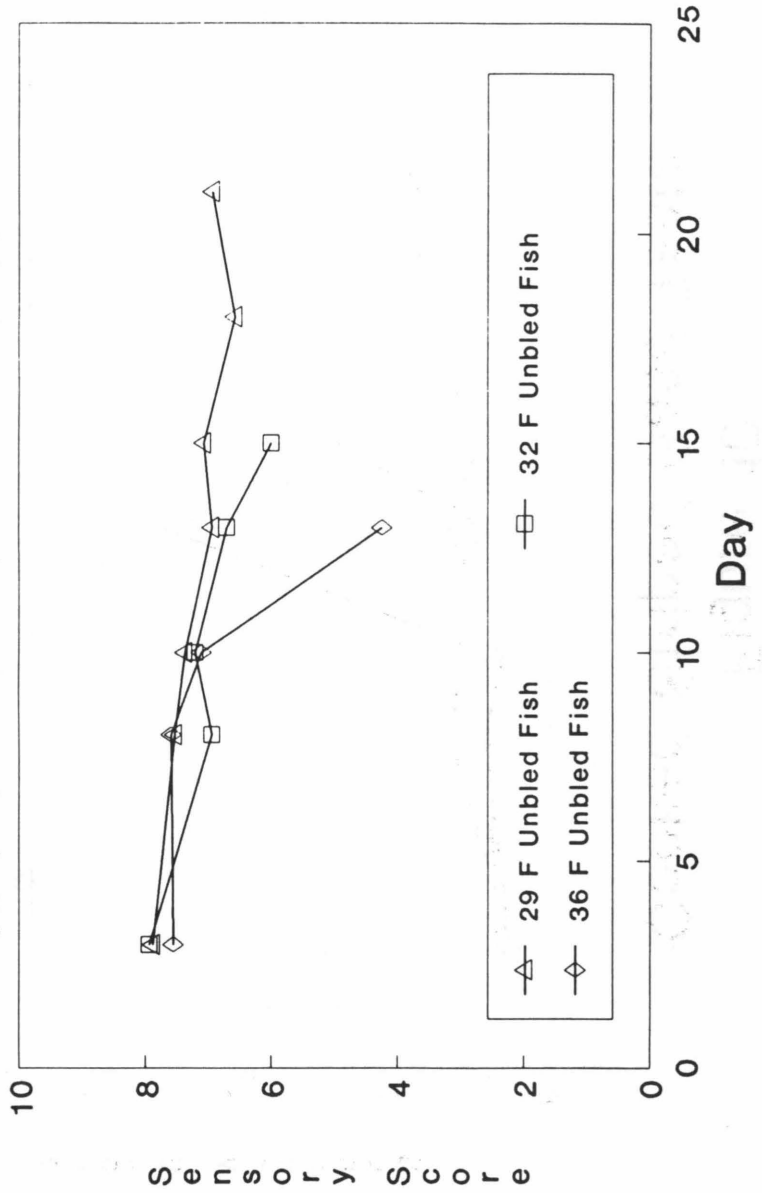


Figure 10  
Cooked Striped Bass Taste

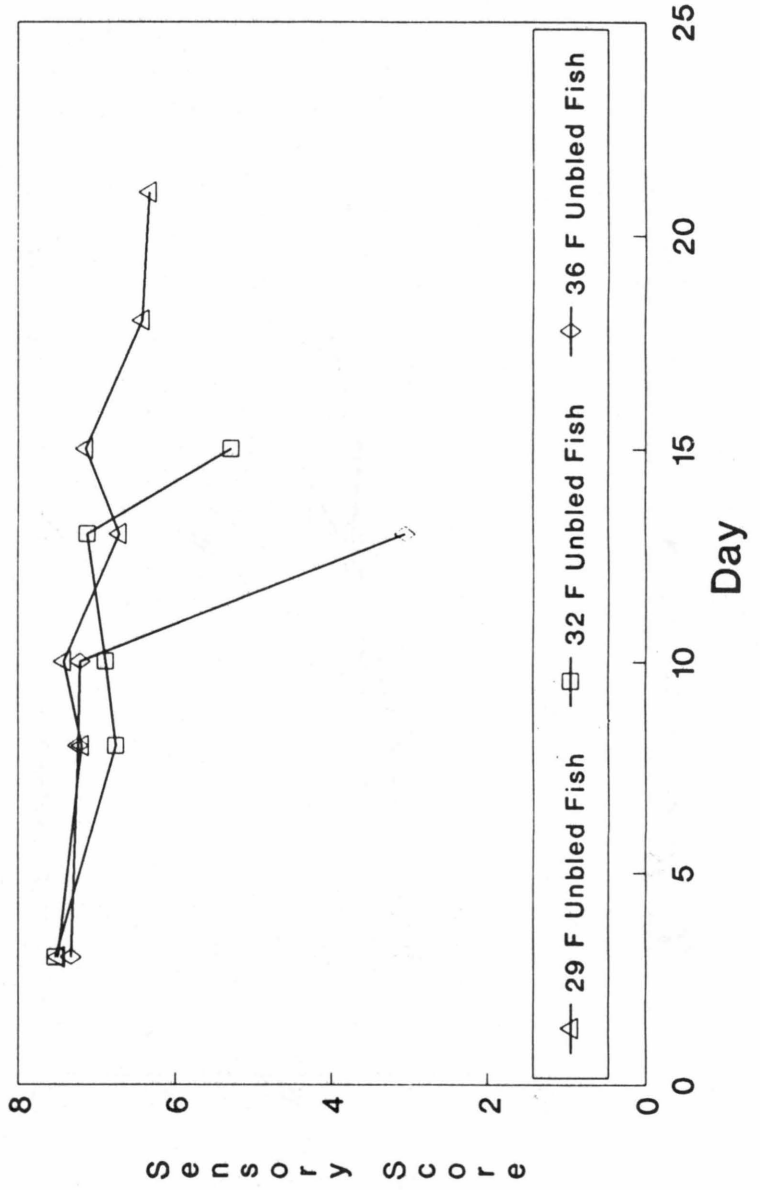




Figure 11  
Cooked Striped Bass Texture

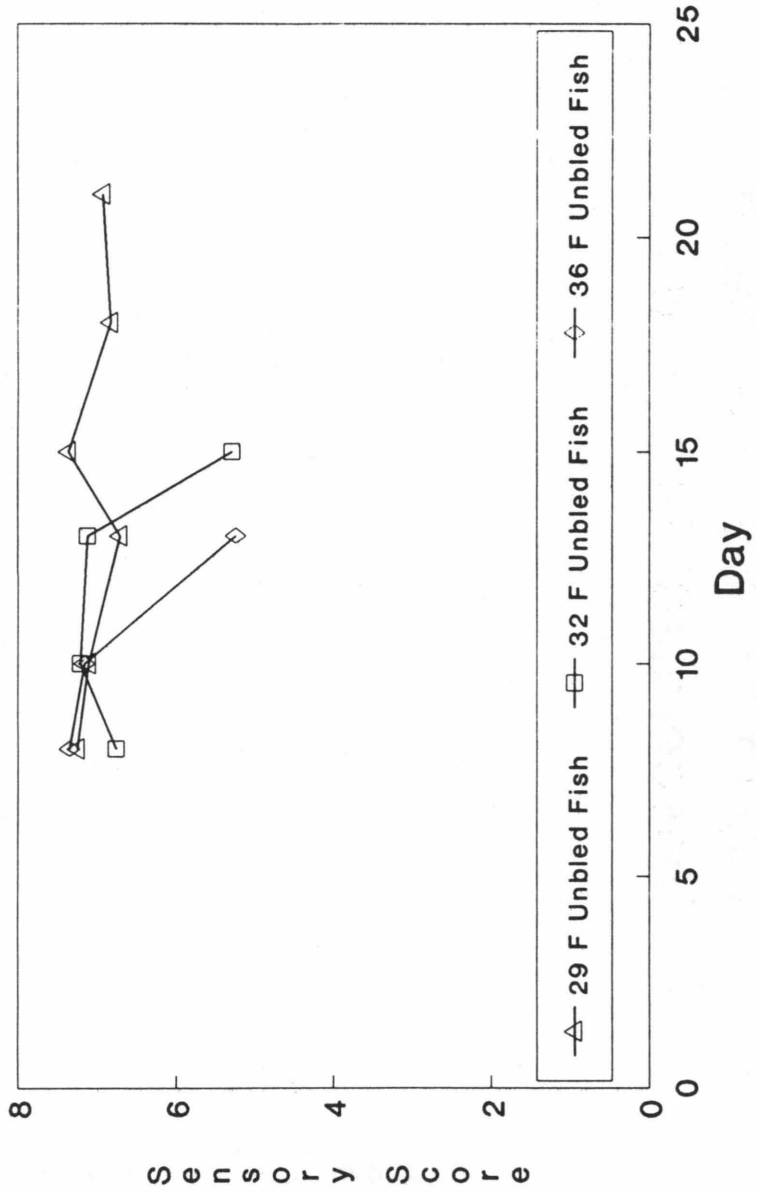
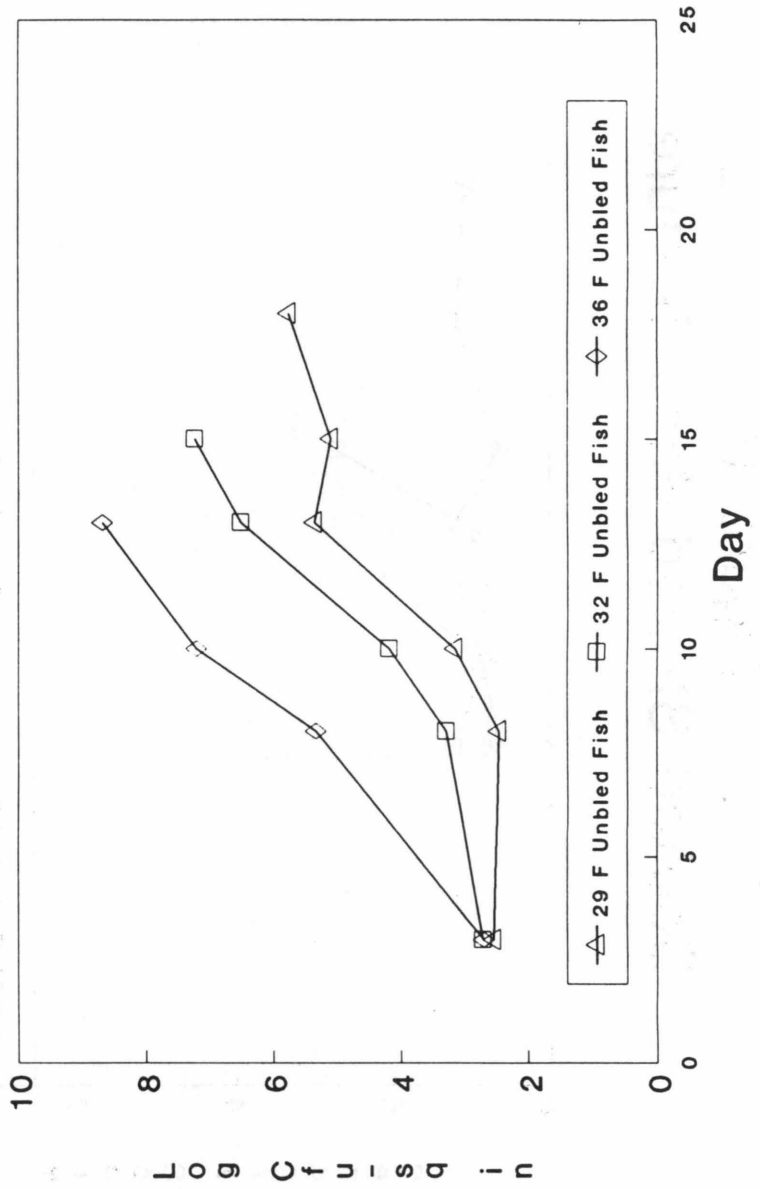


Figure 12 Surface Swab  
Eviscerated Striped Bass



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2. Coale, C.W. Jr., and Tom Hergert, "Sunshine Bass: From Tank to Market." VHS video. Visual Communications Unit, Virginia Polytechnic Institute and State University, Blacksburg, Virginia, June 1992.
3. *Production of Hybrid Striped Bass in a Recirculating Aquaculture System*. Virginia Polytechnic Institute and State University, Blacksburg, Virginia 24061, AQUACULTURE EXPO V, January 12-16, 1992.

## Appendix 1

The Aquaculture Subcommittees organized on July 28, 1989 consisted of the following assignments and people:

### **Production, Harvest and Assembly Committee**

Andrew McLean, Chair  
George S. Libey, Co-Chair  
Don Webster, Co-Chair  
Joe Anthony  
George J. Flick

### **Processing and Distribution Committee**

Parker Mitchell, III, Chair  
George J. Flick, Co-Chair  
Joe Anthony  
Charlie Coale  
Bill Sieling  
Don Webster

### **Retailing and Evaluation Committee**

David T. Wildes, Chair  
Charlie Coale, Co-Chair  
Harold Graul  
Hal Ricker  
Bill Sieling  
Nancy Valley

## Appendix 2

### Acknowledgments

This research study could not have been conducted without the advice, funds support, and work effort given by the following persons and their companies. The Department of Agricultural Economics faculty appreciates the effort contributed by: Joseph P. Anthony Jr., Charles R. Amory, George J. Flick, Harold F. Graul Jr., Daniel Kauffmann, George S. Libey, Andrew Mclean, Parker Mitchell III, Harold Ricker, Tom Rippen, Bill Sieling, Nancy Valley, Don Webster, David T. Wildes, and G.I-Pyo Hong.

Joseph P. Anthony Jr. and Harold Ricker were contact persons from the Agriculture Marketing Service, U. S. Department of Agriculture. J. P. Anthony was the Washington coordinator of the project, and his Branch contributed research funds in support of the study.

Harold F. Graul Jr. provided access to the Graul Markets for the market research study. He provided expert food retailer advice about the marketing details of Sunshine Bass product form, packaging, and personnel to conduct the in-store demonstrations. He provided his store for a parallel training video and served as a principal spokesperson for the video.

Nancy Valley served as the market research coordinator for the inshore consumer assessment program. Mrs. Valley is co-owner of the Smith Island Seafood Company. Mr. Charles R. Amory and Dr. Daniel Kauffmann provided their processing facilities and cutting room labor to process and pack the Sunshine Bass according to the specifications of the research study.

George Flick, G. I-Pyo Hong, and Tom Rippen supervised the taste panel study and the food technology aspects of the study, and provided packaging advice. George S. Libey and members of the Department of Fisheries grew and harvested the Sunshine Bass for this market research study. This production was the first growth trial for the recirculating system at Virginia Tech. Andrew Mclean, Parker Mitchell III, and David T. Wildes are graduates of Virginia Tech. They provided support in collecting data for the consumer acceptance segment. Bill Sieling and Don Webster contributed to the conceptual planning of the study. They represent the aquaculture marketing and production programs in the state of Maryland.

Charles W. Coale, Jr.  
Principal Investigator

## Appendix 3

### Sunshine Bass Recipes

The study team developed two recipes for use in the consumer acceptance evaluations. These recipes were a mild recipe, Sunshine Bass almondine; and a spicy recipe, Cajun style Sunshine Bass. After testing the recipes, the study team selected and used the Sunshine Bass almondine for consumer demonstrations because the fish taste characteristics were not masked by ingredients. The bass almondine gave customers the flavor qualities of the bass and allowed them to be more objective in their survey responses.

#### **Recipe A: Sunshine Bass Almondine**

1 Tbs. liquid margarine	1 Tbs. vegetable oil
1/2 C. all-purpose flour	Salt as needed
1/8 tsp. pepper	Shaved almonds
1 Tbs. fresh minced parsley	
2 to 3 lbs. Sunshine Bass fillets	

In electric skillet add margarine and oil, heat to 350-375 degrees. Rinse fillets in cold water and place on plate. In plastic bag mix together flour, salt, pepper, and parsley. Put fillets in bag, shake well to coat fillets with flour mixture. Saute coated fillets 3-5 minutes per side until golden brown and flaky. Remove to warm plate and sprinkle with toasted shaved almonds.

Serves: 4. Prep time: 20 minutes.

#### **Recipe B: Cajun Style Sunshine Bass**

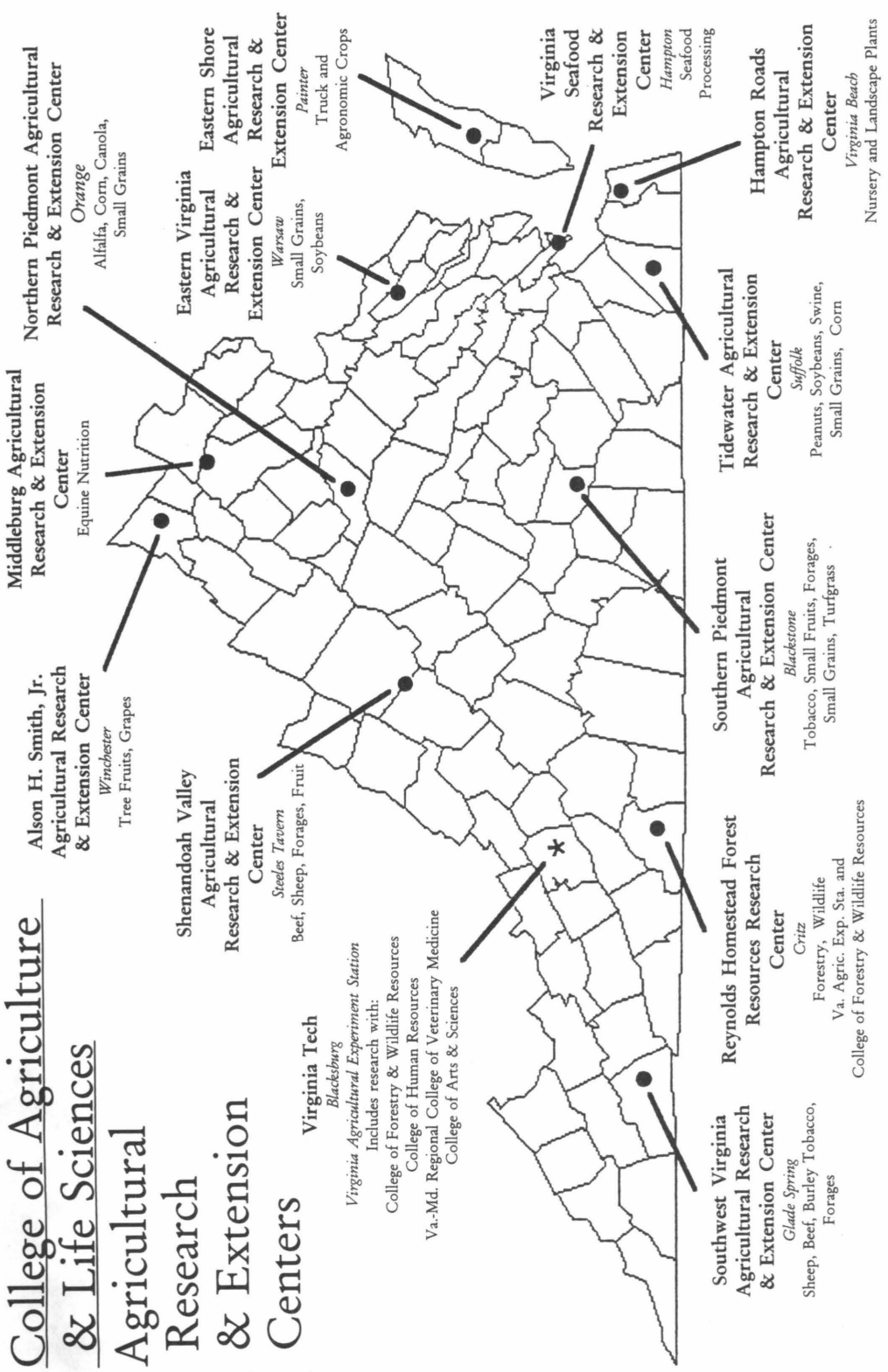
1 Tbs. liquid margarine
1 Tbs. vegetable oil
A pinch Blackened seasoning (Cajun)
2 to 3 lbs. Sunshine Bass fillets

Add oil and margarine to electric skillet and heat to 400 degrees. Rinse bass fillets and sprinkle fish on both sides liberally with blackened seasoning. When skillet is hot, saute seasoned fillets about 3-4 minutes per side or until flaky. They will take on a blackened color from the seasoning. Remove to warm plate and serve with lemon and parsley garnish.

Serves: 4. Prep time: 15 minutes.

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