Bureau of Seafood and Aquaculture Marketing
Florida Department of Agriculture and Consumer Services

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Aquatic Foods Products Laboratory
Department of Food Science and Human Nutrition
Institute of Food and Agricultural Sciences

University of Florida
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Florida Cooperative Extension Service
Institute of Food and Agricultural Sciences

Gulf Oyster Industry Council

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Technology quickly shrinks our ever-changing world. It enables us to become aware of and solve problems with greater efficiency. We now find ourselves with the capability of discovering certain problems that have existed for a long time but only recently have been able to learn the true cause of those problems. So it is with the oyster. Oysters have been a delicacy for centuries. Unfortunately, the oyster industry and the reputation of the oyster as a healthy food source have suffered through occasional media reports which impugn the quality and safety of this tasty treat. A bacteria which exists naturally in oysters worldwide is dangerous for some people with specific pre-existing conditions. A new process of freezing and storing freshly harvested oysters at extremely low temperatures lowers the danger for those individuals and also may bolster sales for the oyster industry. Although this process and the resulting product are relatively new, the results of testing are very encouraging. Further testing and study must be done, but the marketing potential for a bacteria free oyster is virtually limitless.

The Florida Sea Grant College program provided a grant to the University of Florida's Institute of Food and Agricultural Science (IFAS) and the Florida Department of Agriculture and Consumer Services (FDACS), Bureau of Seafood and Aquaculture Marketing (Bureau), in cooperation with the Gulf Oyster Industry Council (GOIC), to study the marketability of a new oyster product.

The University of Florida, IFAS, Gainesville, was responsible for: determining if CO_2, liquid nitrogen or blast freezing will maintain good oyster quality features while lowering a specific bacteria (*Vibrio vulnificus*) content in the oyster meat; optimizing the length of storage time at –10°C in order to achieve the greatest bacteria reduction while retaining the best oyster meat quality; evaluating consumer's ability to detect previously frozen oysters from fresh oysters based on a sensory evaluation test; and, documenting consumers' perceptions and preferences of the products.

The University of Florida, IFAS, North Florida Research and Education Center, Quincy, was responsible for: quantifying the potential market for frozen oyster products at each point in the national seafood market chain (secondary wholesaler, food service, grocery, and independent retailers); identifying and characterizing the oyster consumer in the 48 contiguous states according to demographic and socioeconomic variables; and, projecting the market value and acceptability by oyster consumers and former oyster consumers of oysters treated for *Vibrio vulnificus* that still retain many of the attributes held by raw oysters.

The Bureau of Seafood and Aquaculture Marketing, Florida Department of Agriculture and Consumer Services, was responsible for: grant coordination; developing and distributing the survey targeted toward the secondary wholesaler, food service, grocery, and independent retailers within the seafood industry; developing and publishing four regionally placed media

releases in consumer periodicals designed to emphasize specific oyster attributes, such as value and safety; developing and publishing a media release in consumer and trade magazines outlining the research findings; making available a generic e-mail address (oysters@doacs.state.fl.us) to answer specific questions and generate an anecdotal profile of buyer interest and concerns; planning a workshop consisting of technical presentations and market research results; and, performing on-site interviews with seafood buyers throughout Florida and at the 2000 and 2001 International Boston Seafood Shows.

This report will highlight and discuss the results of the research. In addition, all collateral surveys, press releases and figures are included.

The research effort concentrated on *Vibrio vulnificus*, a naturally occurring bacteria that is concentrated in coastal water oysters. Dr. Gary Rodrick, University of Florida, IFAS, compared the effectiveness of using CO_2, nitrogen, and blast freezing to lower the *V. vulnificus* load while maintaining good oyster quality features. They also compared the effectiveness of freezing whole oysters versus oysters on the half shell and optimized the length of storage time at –10°C to achieve the greatest reduction while retaining the best quality oyster meat. The oysters were frozen using CO_2, nitrogen, and blast freezing depending on the operating equipment of the individual processing plant.

First, Rodrick determined the initial load of *Vibrio vulnificus* in oysters harvested in Florida and Louisiana. A control group was set aside in order to obtain the initial *V. vulnificus* load of the oyster meat. Where possible, the oysters were separated into whole oyster and half shell oyster lots for freezing. To compare, the frozen oyster samples were held for 1, 7, 14, and 21 days at –10°C. The number of *V. vulnificus* were measured for each time frame. Figure 1 shows the *V. vulnificus* count in whole oysters throughout the 21-day test period using carbon dioxide vs. nitrogen as the freezing agent. At the end of the 21-day period, there were no detectable *V. vulnificus* in the samples frozen with carbon dioxide.

Fig. 1

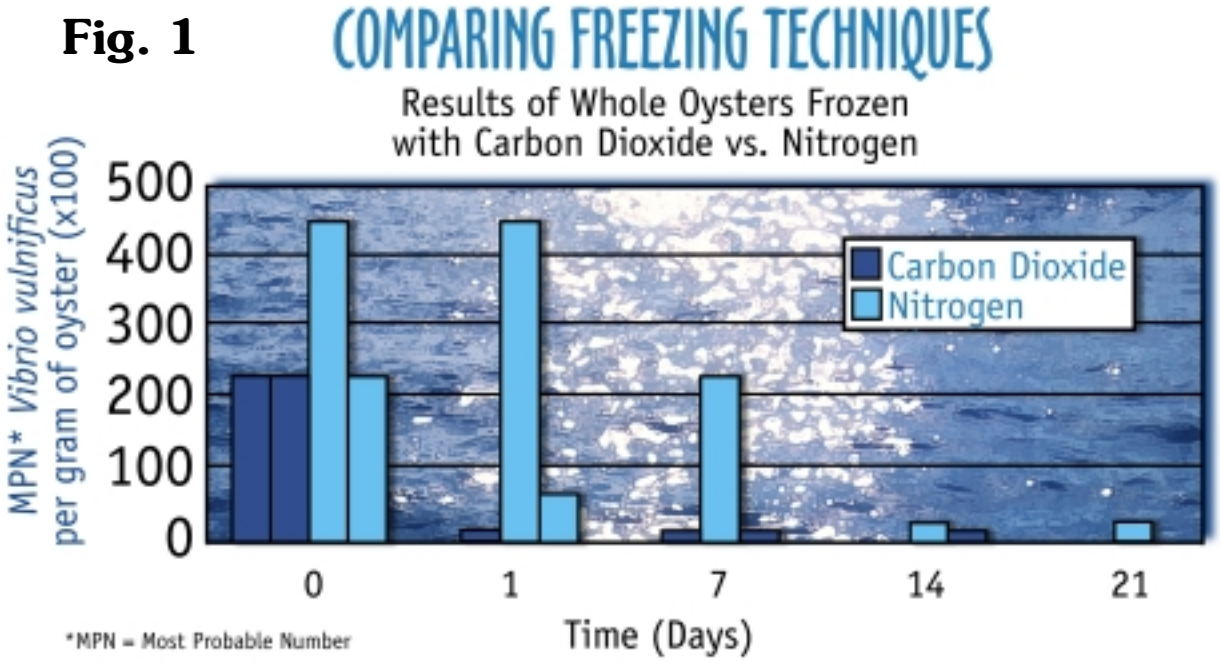
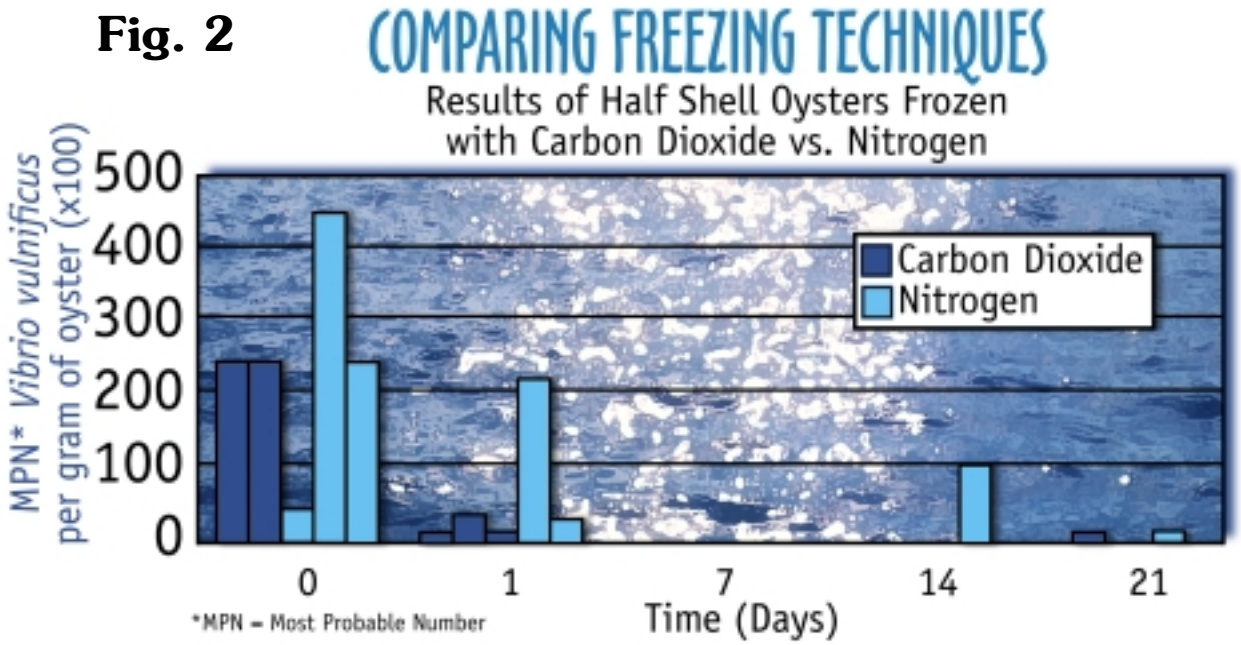


Figure 2 shows the results of freezing half-shell oysters with carbon dioxide vs. nitrogen. This shows nitrogen to be the most effective with no detectable *Vibrio vulnificus* at the 21-day mark.

Fig. 2



When comparing whole oysters with half shell oyster using carbon dioxide and nitrogen as th freezing agents. Carbon dioxide reduced the bacteria level in whole oysters to a non-detectable level after 21 days (see figure 3). Nitrogen seemed to work better on reducing the bacteria level in half shell oysters (see figure 4).

Fig. 3

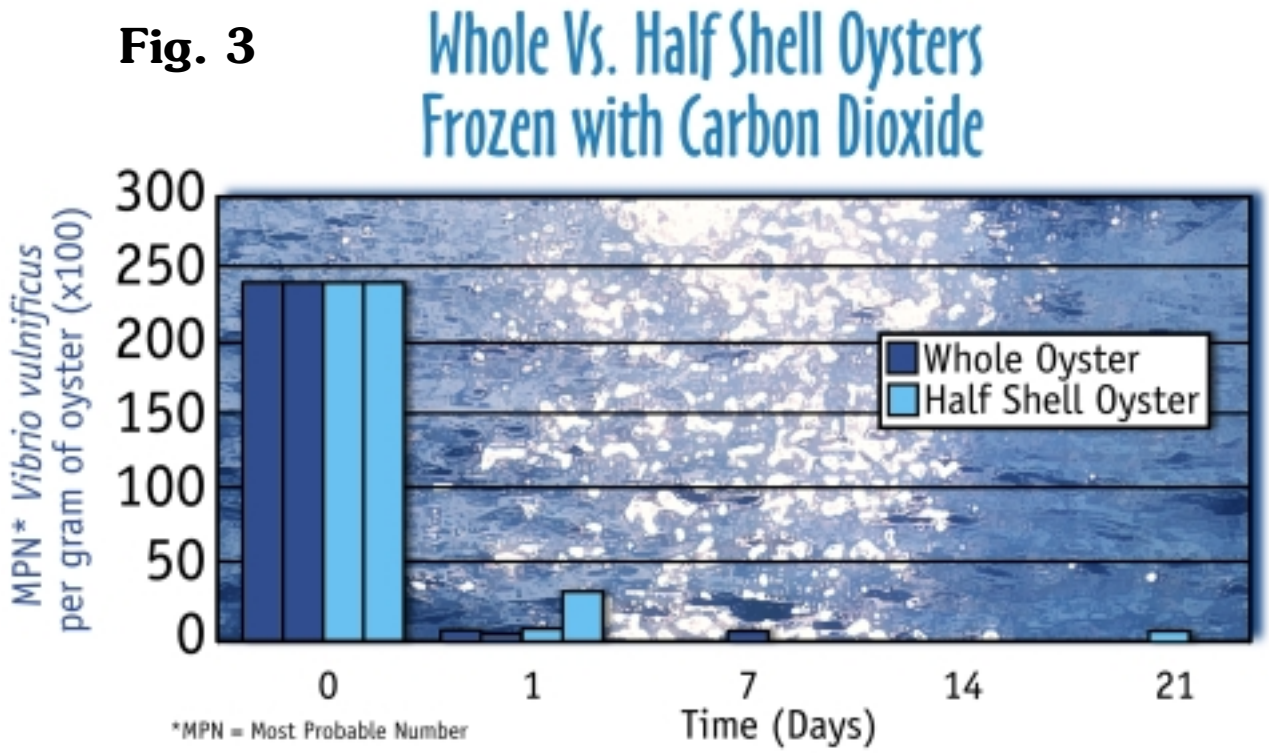
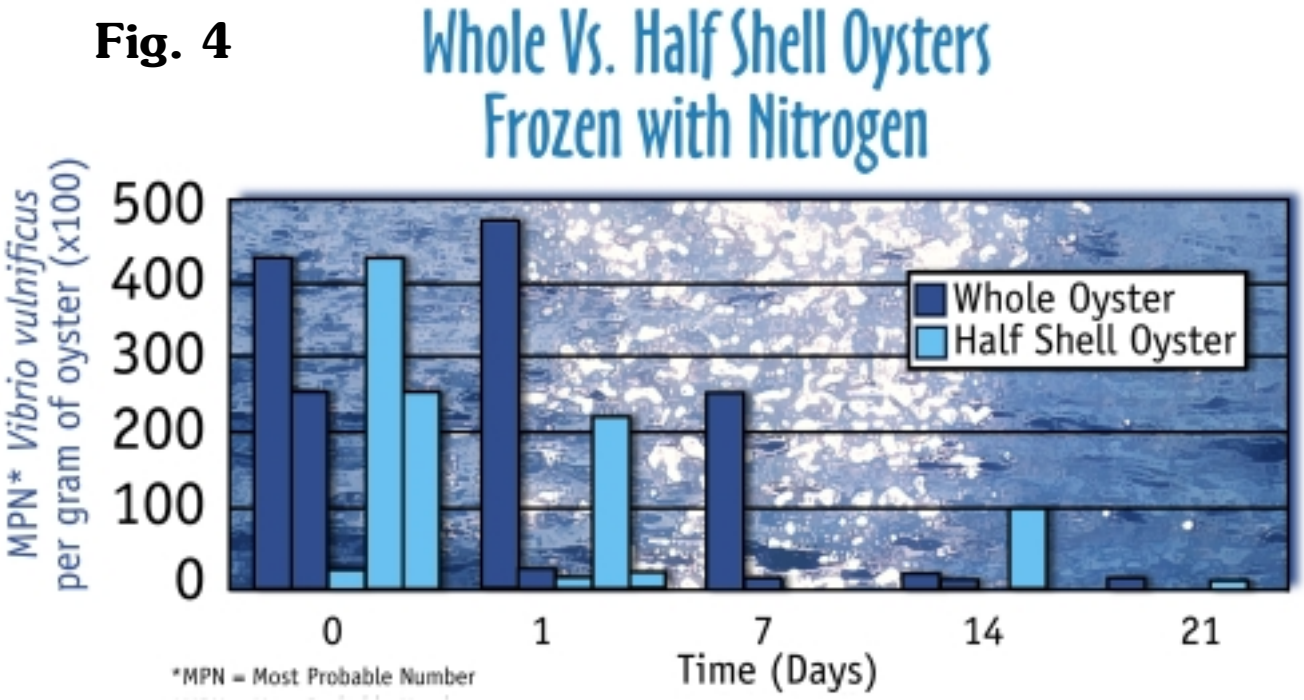


Fig. 4



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A consumer questionnaire (found in Appendix A) was developed by Dr. David Zimet, University of Florida, IFAS, North Florida Research and Education Center and administered by Research Network, Inc., of Tallahassee. It was a telephone survey using a random sample of consumers 18 years of age and older. In order to maintain a high degree of statistical confidence for the individual segments, the consumer survey was targeted for 1800 completions from individuals who have eaten oysters (Table 1). The survey was oriented towards oyster purchase and consumption patterns. The survey was developed to characterize the oyster consumer according to demographic and socioeconomic variables and project the market acceptance of the new product by oyster consumers.

Previous to this study, there was no data to indicate the proportion of the United States population that has consumed oysters. Nor was there a clear demographic profile of the oyster consumer. In order to obtain 1800 completions, over 2800 contacts were made (Table 1).

The 1800 respondents who had consumed oysters represent nearly 63% of the 2863 people contacted. Of the 1800 who had eaten oysters, nearly 42% indicated they liked them. When applicable, the Pearson chi-square test statistic (x^2) is given.

Table 1. Overall sample characteristics.

	Survey contacts	# Respondents who have eaten oysters	# Respondents who like oysters
Number	2863	1800	1199
Percent	100	62.9	41.9

Who Has Eaten Oysters: Demographic Characteristics

The country was divided into five regions, four coastal and one noncoastal (Figure 5):

1. Gulf Coast (region 1) with Florida and Texas included, 327 respondents
2. Atlantic SE (region 2) -- Georgia north through Delaware, 219 respondents
3. Atlantic NE (region 3) – the remainder of the Atlantic seaboard, 312 respondents
4. Pacific Coast (region 4) including Alaska and Hawaii, 319 respondents
5. Remaining states (region 5), 623 respondents

Table 2. People who have eaten oysters and like or dislike them, by region.

	Region 1		Region 2		Region 3		Region 4		Region 5		Total	
	Num.	%	Num.	%	Num.	%	Num.	%	Num.	%	Num.	%
Like	231	70.6	172	78.5	214	68.6	201	63	381	61.2	1199	66.6
Dislike	96	29.4	47	21.5	98	31.4	118	37	242	38.8	601	33.4
Total	327		219		312		319		623		1800	
x^2sig. =.000												

The data indicate residents of the Atlantic SE, the Gulf Coast, and the Atlantic NE respondents are more likely to like oysters than the Pacific Coast and non-coastal respondents (Table 2). Non-coastal residents in particular did not seem to like oysters as much as residents of coastal states. Of the total respondents who have eaten oysters, a somewhat higher percentage of men (72.1%) than women (62.4%) like oysters.

Of those who indicated their age, over 67 % responded that they liked oysters (Table 3). The group percentages varied from a low of 62.8 % for the 30-39 group to 71.2% for the 59+ age group. No discernible pattern was detected when comparing oyster like/dislike to age.

Table 3. People who have eaten oysters and like or dislike them, by age												
Age	18-29		30-39		40-49		50-59		59+		Total	
	Num.	%	Num.	%	Num.	%	Num.	%	Num.	%	Num.	%
Like	148	69.5	177	62.8	267	68.3	167	63	284	71.2	1043	67.3
Dislike	65	30.5	105	37.2	124	31.7	98	37	115	28.8	507	33.7
Total	213		282		391		265		399		1550	
x^2sig. = .064												

Table 4 shows that of those who revealed their income, a significantly larger percentage of those with an annual household income less than $20K (72.4%) or more than $80K (79.6%) liked oysters than all respondents (66.6%).

Table 4 DO YOU LIKE OR DISLIKE OYSTERS? * HOUSEHOLD INCOME Cross-tabulation								
		HOUSEHOLD INCOME						
		LESS THAN	$20,001 -	$40,001 -	$60,001 -	$80,000	REFUSED	Total
Oysters		$20,000	$40,000	$60,000	$80,000	or HIGHER		
Like	Count	89	155	155	96	82	622	1199
	%	72.4	68.6	62.5	64.9	79.6	65.3	66.6
Dislike	Count	34	71	93	52	21	330	601
	%	27.6	31.4	37.5	35.1	20.4	34.7	33.4
Total	Count	123	226	248	148	103	952	1800
	%	100	100	100	100	100	100	100
x^2sig. = .025								

Frequency of Eating Oysters

In Table 5 respondents are classified by region and frequency of eating oysters. A significantly higher percentage (70.3%) of the population in the Atlantic SE region (Region 2) indicated that they had eaten oysters within the previous 12 months. Over 23% of Region 2 residents indicated that they eat oysters once per month or more, which is significantly higher than residents in all other regions. Over 40% of the residents in Regions 3, 4, and 5 had not eaten oysters in the previous twelve months.

Table 5. Question 4. How often do you eat oysters, stratified by region?							
		REGION					
Consumption Frequency		Region1	Region 2	Region 3	Region 4	Region 5	Total
None	Count	126	65	135	148	285	759
	%	38.5	29.7	43.3	46.4	45.7	42.2
< once/month	Count	144	103	131	124	275	777
	%	44.0	47.0	42.0	38.9	44.1	43.2
≥ once/month	Count	57	51	46	47	63	264
	%	17.4	23.3	14.7	14.7	10.1	14.7
Total	Count	327	219	312	319	623	1800
	%	100	100	100	100	100	100
x^2sig= .000							

Table 6 shows consumption frequency by gender. The data shows men are more likely to eat oysters than women. Over 46% of female respondents indicated that they had not eaten oysters within the previous 12 months, while less than 38% of men so indicated. Over 45% of the men indicated that they had eaten oysters less than once per month the previous year and less than 41% of the women had eaten oysters less than once per month. Men were also more likely to be frequent consumers (greater than once per month) than women.

Table 6. Frequency of oyster consumption all respondents versus gender.

		GENDER		
Consumption Frequency		MALE	FEMALE	Total
None	Count	331	428	759
	%	37.6	46.6	42.2
< once/month	Count	402	375	777
	%	45.6	40.8	43.2
≥ once/month	Count	148	116	264
	%	16.8	12.6	14.7
Total	Count	881	919	1800
	%	100	100	100

Table 7 shows that individuals in the $80,000 income range are significantly more likely to eat oysters than the other income ranges. The large number of refusals makes further interpretation of the results tenuous.

Table 7. Frequency of consumption categorized by household income.

	<$20000		$20-40000		$40-60000		$60-80000		>$80000		Refused		Total	
	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%
None	51	41.5	91	40.3	88	35.5	61	41.2	30	29.1	439	46.1	760	42.2
<12X/Yr.	67	54.5	127	56.2	153	61.7	83	56.1	67	65.0	485	50.9	982	54.6
≥12X/Yr.	5	4.1	8	3.5	7	2.8	4	2.7	6	5.8	28	2.9	58	3.2
	123		226		248		148		103		952		1800	

x^2sig = .019

Table 8 shows that with the exception of the group older than 59, at least half of those who responded indicated that they ate oysters at least once in the previous year. Less than 14.6% of those between the ages 30 to 39 and over 59 indicated that they ate oysters at least once per month. Greater percentages (at least 16.2%) of those in other age groups indicated that they ate oysters at least once per month.

Table 8. Frequency of consumption versus age.								
		AGE						
Consumption Frequency		18-29	30-39	40-49	50-59	59+	Refused	Total
None	Count	69	114	146	119	208	103	759
	Percent	32.4	40.4	37.3	44.9	52.1	41.2	42.2
< once/month	Count	107	127	179	103	138	123	777
	Percent	50.2	45.0	45.8	38.9	34.6	49.2	43.2
≥ once/month	Count	37	41	66	43	53	24	264
	Percent	17.4	14.5	16.9	16.2	13.3	9.6	14.7
Total	Count	213	282	391	265	399	250	1800
	Percent	100	100	100	100	100	100	100

In sum, younger males earning more than $40,000 per year and living in the coastal Southeast (Atlantic or Gulf) are more likely to have eaten oysters in the 12 months prior to the study than have other populations.

The Frozen Oyster: Potential Consumers

Two recently developed products were emphasized in this study.

- A frozen oyster on the half shell and
- A whole unshucked frozen oyster.

As in previous sections, respondents are characterized by income, sex, and age. So as to more fully evaluate consumers' interest in frozen oysters, the characterization is cross-tabulated with frequency of oyster consumption. Responses concerning willingness to pay for the product are summarized.

General Interest in Bacteria Free Frozen Oyster

Of the respondents who have eaten oysters, 32.4 % expressed some interest in a new bacteria free frozen oyster. The respondents to this particular question (question 7b in Appendix A) did not indicate a strong difference in product interest by region.

Table 9. Purchasers with an interest in frozen oysters, by region												
Region	Region 1		Region 2		Region 3		Region 4		Region 5		Total	
	Num.	%	Num.	%	Num.	%	Num.	%	Num.	%	Num.	%
Interested in												
frozen oysters	103	31.5	77	35.2	110	35.3	99	31.0	194	31.1	583	32.4
No interest in												
frozen oysters	224	68.5	142	65.2	202	64.7	220	69.0	429	68.9	1217	68.6
Totals	327		219		312		319		623		1800	
x^2sig. = .722												

Regional Potential and Frequency of Recent Consumption

For purposes of this report, recent consumption is defined as consumption within the past year. Table 10 shows that 191 of the 1800 respondents (10.6%) expressed an interest in frozen oysters on the half shell. The highest interest levels came from Regions 1, 2 and 4 with at least 40% of frequent oyster consumers expressing an interest in frozen oysters.

Table 10. Respondents expressing interest in purchasing frozen oysters on the half shell at the supermarket versus frequency of eating oysters by region.

Region	Region 1		Region 2		Region 3		Region 4		Region 5		Total	
Frequency	Num.	%	Num.	%	Num.	%	Num.	%	Num.	%	Num.	%
None	6	18.8	6	20	5	16.1	3	10.3	12	17.4	32	16.8
<Once a month	11	34.4	12	40	18	58.1	13	44.8	41	59.4	95	49.7
≥Once a month	15	46.9	12	40	8	25.8	13	44.8	16	23.2	64	33.5
Totals	32		30		31		29		69		191	
x^2sig. = .208												

Far more respondents (269) indicated an interest in whole frozen oysters (Table 11). The increase is due to an increased interest on the part of the infrequent consumer and non-consumers in nearly all regions of the country.

A smaller percentage of the frequent consumers were interested in the whole frozen oyster than frozen on the half shell. The differences were not significant according to the x^2 statistic.

Table 11. People interested in whole frozen oysters at the supermarket versus frequency of eating oysters by region.

Region	Region 1		Region 2		Region 3		Region 4		Region 5		Total	
Frequency	Num.	%	Num.	%	Num.	%	Num.	%	Num.	%	Num.	%
None	10	21.7	7	17.1	4	9.8	8	18.2	17	17.5	46	17.1
<Once a month	24	52.2	20	48.8	23	56.1	22	50	59	60.8	148	55
≥Once a month	12	26.1	14	34.1	14	34.1	14	31.8	21	21.6	75	27.9
Totals	46		41		41		44		97		269	
x^2sig. = .661												

Frequency of Recent Consumption and Potential by Gender

There is also a strong interest level in frozen supermarket oysters in both men (57.1%) and women (51.4%) groups who are infrequent oyster consumers. For the frequent consumer (once a month or more), gender has no effect on the interest in frozen oysters in the half shell (Table 12). The x^2 statistic, while not significant at the .05 level of significance, does show some indication that a greater percentage of women who had not eaten oysters within the past year would be interested in purchasing frozen oysters.

Table 12. People interested in purchasing frozen oysters in the supermarket versus frequency of eating oysters by gender.

Gender	Men		Women		Total	
	Frequency	%	Frequency	%	Frequency	%
None	26	13.1	32	22.2	58	17.0
<Once a month	112	57.1	74	51.4	186	54.7
≥Once a month	60	29.8	38	26.4	98	28.4
Totals	198		144		342	
X^2sig. = .086						

Potential Consumers by Income and Frequency

Table 13 portrays the income level of the people showing some interest in purchasing frozen oysters. The data suggests that the $60K and higher groups have the strongest interest in frozen oysters.

Table 13. Number and percentage of people interested in purchasing frozen oysters stratified by income.

		HOUSEHOLD INCOME						
		LESS THAN	$20,001-	$40,001-	$60,001-	$80,000	Refused	Total
Interest Level		$20,000	$40,000	$60,000	$80,000	or HIGHER		
No interest	Count	85	152	152	85	67	676	1217
	%	69.1	67.3	61.3	57.4	65.0	71.0	67.6
Somewhat interested	Count	29	55	76	47	26	224	457
	%	23.6	24.3	30.6	31.8	25.2	23.5	25.4
Very interested	Count	9	19	20	16	10	52	126
	%	7.3	8.4	8.1	10.8	9.7	5.5	7.0
Total	Count	123	226	248	148	103	952	1800
	%	100	100	100	100	100	100	100
x^2sig. = .024								

Potential Supermarket Consumers of Frozen Oysters

Over 10% of the sample group indicated a willingness to purchase frozen oysters on the half shell from the supermarket (Table 14). There did not appear to be any significant difference in levels of interest among the regions.

Table 14. Purchasers willing to purchase frozen oysters on the half shell in supermarket, by region.

Region	Region 1		Region 2		Region 3		Region 4		Region 5		Total	
	Num.	%	Num.	%	Num.	%	Num.	%	Num.	%	Num.	%
Will buy frozen oysters	32	9.8	30	13.7	31	9.9	29	9.1	69	11.1	191	10.6
No interest in frozen oysters	295	90.2	189	86.3	281	90.1	290	90.9	554	88.9	1609	89.4
Totals	327		219		312		319		623		1800	
x^2sig. = .447												

Table 15 shows 14.9 % of the positive respondents are interested in purchasing whole frozen oysters in the supermarket. Again, there does not appear to be any significant differences among the regions.

Table 15. Purchasers willing to purchase whole frozen oysters in supermarket, by region.

Region	Region 1		Region 2		Region 3		Region 4		Region 5		Total	
	Num.	%	Num.	%	Num.	%	Num.	%	Num.	%	Num.	%
Will buy frozen oysters	46	14.1	41	18.7	41	13.1	44	13.8	97	15.6	269	14.9
No interest in frozen oysters	281	85.9	178	81.3	271	86.9	275	86.2	526	84.4	1531	85.1
Totals	327		219		312		319		623		1800	
x^2sig. = .409												

One additional point should be made regarding Tables 14 and 15. Because there is an overlap in positive responses, the total number of individuals interested in purchasing frozen oysters in some form in the supermarket is not the sum of the "will buy" frozen oysters row and totals column. Some respondents are willing to purchase both whole frozen oysters and frozen oysters on the half shell. Table 16 shows a matrix of potential whole frozen and frozen on the half shell supermarket purchasers.

Table 16.	Purchase Frozen Half Shell		
	Yes	No	Totals
Purchase Whole Yes	118	151	269
Frozen Oysters No	73	1458	1531
Totals	191	1609	1800

A total of 342 individuals would be willing to purchase frozen oysters in some form from the supermarket. They represent 19.0% of the 1800 respondents.

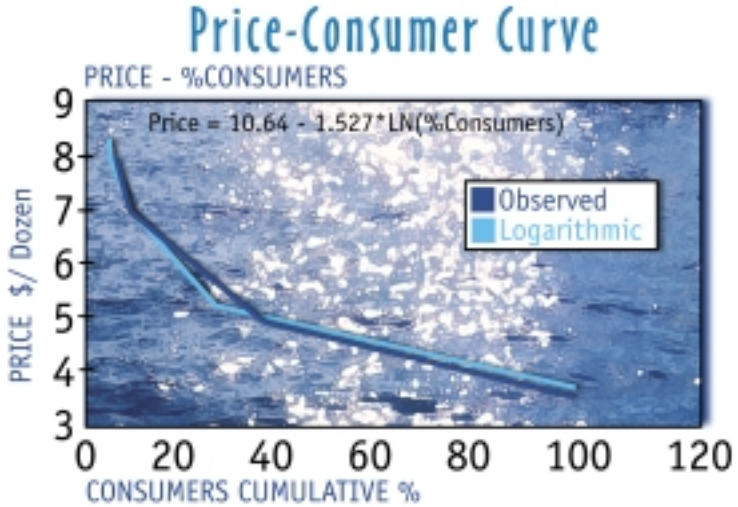
The 19.0% interested in frozen supermarket oysters is somewhat less than the 32.4% expressing an interest in frozen oysters in general shown earlier in Table 6. This data suggests there is a potential group of consumers (13.6%) interested in frozen oysters for restaurant consumption but not interested in frozen supermarket oysters.

Willingness To Pay and Size of Market

As indicated in Table 17, 39.7% of the positive respondents are willing to pay at least $5/dozen for frozen oysters. Almost 77% of the sub-group willing to purchase frozen oysters in the supermarket are willing to pay at least $5 per dozen.

Table 17. Willingness to pay for frozen oysters (question 13)				
	All Consumers		Will Purchase in Supermarket	
	Frequency	%	Frequency	%
<$5/doz.	1086	60.3	70	23.1
$5/doz.	243	13.5	84	24.6
$6/doz.	259	14.4	70	20.5
>$6/doz.	212	11.8	109	31.8
	1800		342	

A price–consumer curve was developed from the data. This curve is shown in figure 6. The data indicate that 30% of the respondents who would purchase frozen oysters in the supermarket would pay at least $5.50/dozen.



Market Size and Potential

Table 18 shows the percentage of the population and the frequency that they eat oysters. It is interesting to note that only 14.8% of the population that like oysters consume approximately 83% of all oysters. An estimate of potential market size for the frozen half shell and whole frozen markets are given in columns 3 and 4. The assumptions are:

30% of the positive respondents will pay $5.50/dozen for frozen oysters

10.6% and 14.9% of the population will purchase oysters in the supermarket (Tables 13 and 14) Over 200 million people in the U.S. are over 18. 1800 out of 2863 is the number of positive respondents to question 2 (Do you like oysters?)

Table 18. Potential Frozen Oyster Market in MM (million) dozens is:

	% of Pop.	half shell	whole
Frequency/yr.	Like Oysters	MM Doz.	MM Doz.
0	42.2	0.00	0.00
1	24.3	0.97	1.37
3	18.5	2.22	3.12
12	6.7	3.22	4.52
24	3.9	3.74	5.26
36	1.2	1.73	2.43
48	1.5	2.88	4.05
60	1.5	3.60	5.06
Totals	99.8	18.36	25.80
Assumes one dozen oysters eaten per each oyster consumption event.			
Groups > 12X/yr.	14.8	15.17	21.31
Percent of total	14.8	83%	83%

Table 18 indicates the potential market size for:

- Frozen oysters on the half shell @ $5.50/dozen = 0.3*0.106*200*1800/2863 = 4.00MM dozen oysters
- Whole frozen oysters @$5.50/Doz. = 0.3*0.149*200*1800/2863 =5.62MM dozen oysters.

The retail value for the respective markets would be:

- Frozen half shell = 18.36*5.50 = $101MM
- Whole frozen market = 25.8*5.50 = $141.9MM

Health Concerns

A large percentage of the respondents (70.8%) were aware of the dangers of eating raw oysters. Table 19 shows that respondents with health concerns (question 5b) about eating oysters were significantly more likely to purchase frozen oysters in the supermarket than the positive respondent sample as a whole. Over 22% of the subgroup with health concerns would purchase whole frozen oysters in the supermarket, compared to 14.9% of all respondents. Fewer respondents (17.4%) with health concerns would purchase frozen oysters on the half shell in the supermarket but this is still higher than the 10.6% for all respondents.

Table 19. Would you purchase frozen oysters in the supermarket stratified by sub-group having health concerns about eating oysters.								
	Whole Frozen Oysters				Frozen Oysters on the Half Shell			
	Health Concerns		Total Positive Resp.		Health Concerns		Total Positive Resp.	
	Num.	%	Num.	%	Num.	%	Num.	%
Would purchase oysters in the supermarket	124	22.3	269	14.9	97	17.4	191	10.6
Would not purchase oysters in supermarket	432	77.7	1531	85.1	459	82.6	1609	89.4
Totals	556		1800		556		1800	
	x^2sig. = .447				x^2sig. = .447			

Table 20 concerns question 7b. Do you believe that a new method of freezing oysters could reduce bacteria to non-detectable levels?

- 31% of respondents believe the statement.
- 65% do not believe the statement.
- Only 4% were not sure or didn't know whether to believe the statement.

This suggests the importance of educating the consumer regarding the health and safety benefits of post harvest treated oysters.

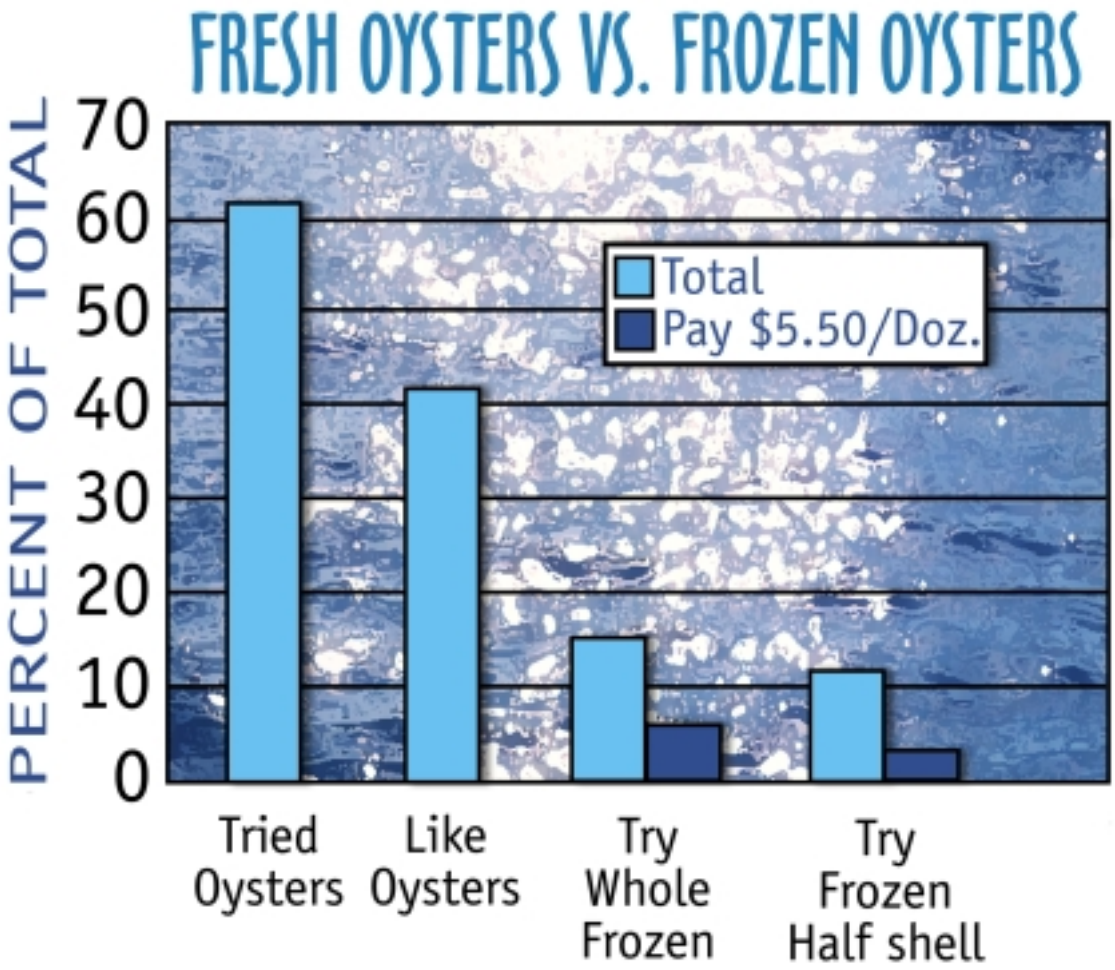
Table 20. Question 7b. Do you believe that a new method of freezing oysters could reduce bacteria to non-detectable levels?			
Believe statement	Frequency	Percent	
Yes	556	30.9	
No	1166	64.8	
DK/Not Sure	78	4.3	
Total	1800	100.0	

Consumer Survey Conclusions

- 63% of the 2863 individuals surveyed had eaten oysters.
- 42% of the individuals surveyed liked oysters.
- 32.3% of respondents liking oysters, indicated some interest level in frozen oysters with non-detectable bacteria levels.
- Men are significantly more likely to have eaten oysters within the past year than women and are also more likely to be frequent oyster consumers than women.
- 14.9% of individuals who have eaten oysters expressed an interest in whole frozen oysters.
- 10.6% of individuals who have eaten oysters expressed an interest in frozen oysters on the half shell.
- The total number of individuals interested in purchasing oysters in the supermarket was 19% of those who had eaten oysters.

Willingness to Pay and Market Size

- The optimum price appears to be $5-5.50 per dozen based purely on demand.
- The demand elasticity suggests a drop in price from $5.50 to $5.00 would increase market size from 30% to approximately 40% of the individuals interested in purchasing oysters on the half shell in the supermarket.
- 3.2% of individuals who like oysters are willing to pay a minimum of $5.50/dozen for frozen oysters on the half shell in the supermarket.
- The potential market size for frozen oysters on the half shell @ $5.50/Doz. is 4.0MM people.
- Potential Market size for whole frozen oysters @$5.50/Doz. is 5.6MM people.
- Approximately 15% of individuals who like oysters consume 83% of the oyster market.



Health Concerns

- Respondents who believe the new method of freezing oysters reduces bacteria are more likely to purchase frozen oysters.
- Respondents who believe the new method of freezing oysters reduces bacteria are willing to pay more for frozen oysters.
- 69% of the individuals who like oysters either don't believe (65%) or don't know (4%) if there was a new method of freezing oysters that could reduce bacteria to non-detectable levels.

Consumer Profile

The typical frequent oyster consumer is male and in the 18-49 age group. He is likely to live in a coastal area and have a high income.

The Trade Survey

Only recently have frozen whole and half-shell oyster products that have no detectable level of *Vibrio vulnificus* been made available to the food service industry. As part of the grant requirement, and in an effort to gauge interest in this new product, the Bureau developed and mailed a trade survey (Appendix B) to over 24,000 seafood buyers around the country. In order to evaluate the market potential of these products, FDACS contracted with Dr. David Zimet, University of Florida, to analyze data from the survey targeted to companies such as restaurants, brokers, and transporters. Because the product was already available to the food industry the survey was oriented more toward perceptions and experience with the new product. Additional information on packaging was also collected.

Correlations

Correlation is a measure of association or dependence between two variables or items. Correlation coefficients range between 0.0 (no association) and 1.0 (complete association). A correlation coefficient of 0.40 between two items indicates that they depend on each other to a great extent, increasing or decreasing together 40% of the time. There is moderate correlation between offering frozen oysters and the reasons listed in the questionnaire for offering them (seasonal availability, shelf life, and storage).

Potential problem areas (taste, texture, appearance, and food borne illness) are moderately associated with each other and with reasons why respondents indicated that they would purchase frozen oysters (seasonal availability, storage, and shelf life).

Of the 543 respondents, 44.4% wanted half shell and 36.3% wanted whole frozen oysters.

Strong correlations > 0.40

- Survey respondents aware of one type frozen oyster are usually aware of both whole frozen and frozen half shell.

• If respondents had problems with appearance, they were more likely to have problems with shelf life, grittiness and food borne illness as well.

Medium correlations (0.2-0.4)

• Respondents currently offering frozen oysters correlate with why they would purchase frozen oysters. (seasonal availability, shelf life, etc.)
• Respondents expecting a sales increase by offering frozen oysters are also more willing to pay a premium.
• Survey respondents experiencing oyster appearance problems more likely to be aware of frozen half shell oysters.
• If the respondents were previously aware of frozen oysters, they were more likely to prefer frozen half shell.
• Taste, texture, appearance and food borne illness characteristics correlate with each other and why survey respondents purchase oysters (shelf life and health reasons).
• Smaller packages correlate with wholesalers that have experienced problems with short shelf life.
• Survey respondents expecting to increase sales with frozen oysters are more willing to pay a premium.
• Survey respondents expecting to increase sales with frozen oysters are more likely to purchase frozen oysters when fresh supply is low.
• Survey respondents expecting to increase sales with frozen oysters are more likely to be interested in a long shelf life product.
• Of the people responding 44% wanted half shell and 36% wanted whole frozen oysters.

Packaging

• 84% of respondents preferred half shell frozen oysters packaged on trays.
• 52% of respondents choosing trays wanted 6 trays of 24 oysters/tray; the remaining 48% of respondents chose 12 oysters/tray.
• 55.8% of respondents chose bubble pack lining in their boxes, the remaining 44.2% chose trays with no bubble pack liner.
• 89% chose some form of box for the package in lieu of sacks.

Buyer type

• 92% of all buyers answered yes to whether consumers would be willing to buy frozen oysters at the supermarket.
• Segregating the buyers by buyer type did not show any significant differences among types. (Table1)

	Wholesaler	Retail Food Service	Supermarket Buyer	Independent Retail Buyer	Overall
% Yes	90	96	94	83	92
% No	10	4	6	17	8
Number	70	68	34	48	228

Trade Survey Conclusions

There did not appear to be a relationship between wholesalers currently offering frozen oysters and previous problems with appearance, grittiness, long shelf life and food borne illness.

Wholesalers by type did not show any particular preference for half shell or whole frozen oysters.

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Oysters are a very popular seafood item in Florida and in the US. Most consumers are used to eating this nutritious seafood raw. Unfortunately, there is risk associated with consuming raw oysters for people with compromised immune systems. The problem is natural microorganisms, such as *Vibrio vulnificus*, which thrive in warm coastal waters approved for shellfish harvest and recreational activity. Mindful of these concerns, commercial practice has developed alternative products with extended shelf life and reduction of the microbial pathogens. Previous work suggested that freezing reduces microorganisms of concern such as *Vibrio vulnificus* to undetectable levels. Frozen oysters may have the potential of being a safer market form. However, consumer acceptability is in question. Even though the product remains raw after thawing, changes in appearance, texture and flavor may affect consumer perceptions. This work was designed to evaluate consumer's ability to detect previously frozen oysters from fresh oysters based on sensory evaluation test and to document the perceptions and preference of the products. The taste test was facilitated by: L.R. Garrido, R. A. Benner, V.M. Garrido and W.S. Otwell of the University of Florida, Aquatic Food Products Laboratory.

Sample Background and Procurement

Oysters were harvested from the Gulf of Mexico. They were transported to the processing plant in compliance with state regulations for half shell consumption. Product was received and stored in refrigeration at 45°F (ambient temperature) until processed. The oysters were processed by manually removing the top shell, and then they were individually frozen in a carbon dioxide tunnel. After freezing, they were glazed, packed and stored at –10°C for 21 days. The fresh oysters used in comparison with the frozen oysters were harvested from the same growing area as the oysters used for frozen samples.

Both samples, fresh, whole oysters and frozen on the half-shell, were delivered to the Aquatic Food Products Lab by refrigerated truck. Both samples were stored overnight at refrigerated temperature of 38°F. Within 48 hours after harvest, the fresh oysters were shucked and then stored on ice in pre-labeled containers until consumed. The previously frozen oysters that thawed overnight were also placed on ice in pre-labeled containers.

Consumer Discrimination Test

The product comparison procedure was based on triangle testing where the panelists were asked to distinguish the odd or different sample among three samples (Appendix C). The two similar samples were either the previously frozen oysters or the fresh oysters. All different variable combinations were presented approximately the same number of times in random order through the taste panel (Appendix D). All oyster samples were served at the same temperature (~45°F). The data was recorded as the number of correct judgments. Prior to the taste panel, all recruited participants were asked to sign a consent form with information that listed the risk factors for consuming raw oysters. Participant demographics were tabulated in Appendix E.

Statistical Analysis

To determine if a significant difference existed, the number of correct responses was compared to a chart of the number of correct responses needed to be significant at a level of 0.05 (Sensory Evaluation Techniques, 3rd edition, M. Meilgaard, G.V. Civille and B.T. Carr; CRC Press, 1999 Washington, D.C.)

Results and Discussion

Results from the triangle testing indicated that there is a significant difference. More than half of the panelists (55%) could detect a difference between the fresh oysters and the previously frozen oysters. Of the 37 correct responses, 51% found the previously frozen sample to be more acceptable while 49% indicated preference for the fresh product. The difference between the samples was found to be slight by 11 panelists (30%), moderate by 19 panelists (50%) and large by 7 panelists (20%).

The fresh oysters were judged to have a more "salty flavor" or "very salty flavor," which was more fresh or oceanic. The product texture was less chewy; the meats appeared to be "bigger" and looked better than the previously frozen oysters. The frozen oysters were rated to have less salty flavor and sweeter taste, more firm or chewier texture, and were found to have a strong, fishy smell.

Taste Test Conclusions

This one time study indicates that the human palate can distinguish fresh oysters from similar previously frozen oysters. In the discrimination taste test, more than half of the panelists could detect a difference between fresh oysters and previously frozen oysters.

There was no clear-cut preference between previously frozen and fresh oysters as indicated by the results. Both products were accepted and /or preferred equally.

A consumer side-by-side acceptability study might help provide more information.

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Media, Trade and Consumer Education

The Bureau developed and distributed four regionally targeted press releases to over 1,500 daily newspapers throughout the United States. These press releases (Appendices F, G) were designed to emphasize specific oyster product attributes such as value, flavor, nutrition or safety. They included a consumer incentive (recipe and product information). The Bureau also developed another press release, in conjunction with Otwell and Rodrick, describing the research findings. This release (Appendix H) was distributed to over 65 consumer and trade magazines. An example of the media attention this project has received can be found in Appendix I (an article in *Meat and Seafood Merchandising* magazine). The Bureau distributed over 15,000 colorful brochures containing cooking tips, recipes and proper care and handling of oysters during the grant period.

Based on the results of the trade and consumer surveys, the Bureau and the GOIC are marketing this new oyster product to the seafood industry and consumers. The Bureau participated in the Aquaculture 2001 Expo in Orlando, January 2001. The Expo, which is the largest aquaculture trade show in the Western Hemisphere, was the venue for a workshop. The workshop, entitled "Safer Oysters: Research and Marketing," presented and provided an overview of the findings. Attendees had an opportunity to learn about current and future trends in the oyster industry, including research on developing a safer raw oyster. On site interviews with major buyers throughout Florida and at the 2000 International Boston Seafood Show were conducted to determine if the frozen oysters would be accepted in the open market. The results of these interviews indicated that price and consumer acceptance would be primary considerations in determining future sales. Buyers were also educated about the results of the research at the 2001 Boston Show.

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CONCLUSION

A grant from the Florida Sea Grant College Program has allowed researchers to analyze the viability of frozen oysters and the acceptability of the products by means of laboratory, consumer and industry research. The laboratory research shows that this new product, when exposed to extremely low temperatures for specific periods of time, shows no detectable signs of the bacteria *Vibrio vulnificus*. The consumer and trade research proves there is potential for growth. There needs to be continual education to the trade, health care professionals and at-risk consumers about this new product.

More information is available at www.fl-seafood.com. Consumers and buyers can e-mail their questions about oysters and this new product to oysters@doacs.state.fl.us. Consumers can also request a colorful brochure containing cooking tips, recipes and proper care and handling of oysters by writing the Bureau of Seafood and Aquaculture, 2051 East Dirac Drive, Tallahassee, Fl 32310 or e-mail <balthrp@doacs.state.fl.us>.

We Would Like To Thank:

The Florida Sea Grant College Program for their funding and guidance.
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Wilson's Seafresh for product supply and facility usage.
Lombardi's Seafood for product supply and facility usage.
Nature Coast Industries for facility usage.
Pristine Oyster Inc. for product supply and facility usage.
A special thanks to the Gulf Oyster Industry Council for their advice and expertise.

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1998. Applewhite, L.D and Otwell, W.S. Value Added Concept for a Safe, Alternative Market From for Florida Clams

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Appendix A

Questions Oyster Consumer Survey (101900 Bur Sea)

Area Code: _____

Region of Country: FL, TX, LA, MS, AL __1 GA, SC, NC, VA, MD __2 DE, PA, NJ, NY, CN, RI, MA, ME __3 CA, OR, WA, AK, HI __4 Other ___5

Ask to speak to the person in the household who will be next to celebrate his or her birthday and be at least 18 years of age. If the person is not there, call back.

Question 1. Have you ever eaten oysters? Yes ___ No ___

What is the main reason you have never eaten oysters? (Don't read list)

1. Appearance
2. Smell
3. Slimy
4. Color
5. Other physical (Specify)
6. Think would taste bad
7. Think grit/internal waste is bad
8. Aversion to new things – no specific reasons
9. Allergies – Dr.'s advice or personal experience
10. Dr's advice – illness, not allergies
11. Personal safety concerns/illness, not allergies

TERMINATE INTERVIEW

Question 2. Do you like or do you dislike oysters?

Like ___ Dislike ___

What is the main reason you dislike oysters? (Don't read list)

1. Appearance
2. Smell
3. Slimy
4. Color
5. Other physical (Specify)
6. Think would taste bad
7. Think grit/internal waste is bad
8. Aversion to new things – no specific reasons
9. Allergies – Dr.'s advice or personal experience
10. Dr's advice – illness, not allergies
11. Personal safety concerns/illness, not allergies

Question 3.

a.) Are you aware of the dangers of eating raw oysters? Yes __1 No __0

b.) Where are the oysters that you usually eat come from?

Gulf Coast _____ Atlantic _____ Pacific _____ Don't Know _____

Question 4. How frequently, if at all, did you eat oysters during the past year? (Don't read list.)

(0) None

Why did you not eat oysters during the past year (Don't read list.)

1. Medical advice of a doctor
2. Personal safety concerns
3. Lack of opportunity (didn't eat out)
4. Not readily available
5. Not in the mood / no appetite for oysters
6. Other (specify) _____

1) Once
2) Once or twice every six moths
3) Once per month
4) Twice per month
5) Three times per month
6) Four times per month/once per week
7) More than once per week – How many times per week ____ times

Question 5a.Would you eat raw oysters more often if they were readily available year around?

Yes___1 No ____0

5b.) Would you eat raw oysters more often if health and safety concerns were reduced or eliminated?

Yes___1 No___0

Question 6. - Where do you usually purchase oysters for consumption at home?

Restaurant __1 Oyster bar __2 Seafood Market __3 Retail Grocery Store__4

Question 7 – There is a new method of freezing oysters, which has no detectable harmful bacteria. It has the taste, texture and appearance of a fresh oyster for up to a year.

a.) Do you believe that statement? Yes___ No ___.

b.) How would you describe your interest in such a product:

No interest ____1 Somewhat interested ____ 2 Very interested ____3

Question 8 – Would you or would you not purchase frozen oysters whole (unshucked) at the supermarket?

Yes _____ No _____ (If no then go to question 11)

Question 9 – How many frozen oysters/package would you prefer? _____

Question 10 - When purchasing frozen oysters in the full shell:

a.) Would you prefer them shrink wrapped? Yes _____ No _____

b.) Which type of supermarket packages would you prefer?

Loose in a plastic __1 Clear plastic tubes ___2 Solid boxes ___3

Question 11 - Would you or would you not purchase frozen oysters on the half shell?

Yes _____ No _____ (If no then go to Question 13.)

Question 12 – When purchasing frozen oysters on the half shell:
Which type of supermarket packages you would prefer?

Shrink wrapped trays in solid cardboard box. ___1

Shrink wrapped trays in cardboard box with window ___2

Vacuum package placed in solid cardboard box ___3

Vacuum package placed in cardboard box with a window ___4

Note for the person giving the survey. Randomly substitute one of the line items (2,3,4 or 5) in Table 1 into the $ space in question 13. If the respondent answers yes, go to the next higher value and repeat the question until the respondent answers no or line item 5 is completed in the table. Enter into 13b the line item corresponding to the last yes from the respondent. If the respondent answers yes to line item 5, then enter 6 into question 13 b. If the respondent answers no to the initial question, go to the next lower value and repeat the question until the respondent answers yes or line item 2 is completed. Enter into question 13b the line item corresponding to the respondents yes answer. If the respondent answers no to line item 2, then enter 1 into question 13 b.

Question 13.
a. Would you be willing to pay $_____ for a dozen frozen oysters purchased in the supermarket?
Yes____1 No ____0
b.) Enter the final selection here _____

Table 1
(1). Less Than $5/dozen
(2) $5/dozen
(3) $6/dozen
(4) $7/dozen
(5) $8/dozen
(6) More than $8/dozen

Question 14. Would you purchase other oyster products such as Oysters Rockefeller or Oysters Casino that were frozen and packaged in the same manner?

Yes___1 No ___0 If question 14 answer = no then go to question 17.

Question 15. How many Oysters Rockefeller per package would you prefer? ____

Question 16. Would you like your Oysters Rockefeller/Oysters Casino packaged in:

Shrink wrapped trays in solid cardboard box. __1

Shrink wrapped trays in cardboard box with window ___2

Vacuum package placed in solid cardboard box ___3

Vacuum package placed in cardboard box with a window __4

Question 17.

Sex: M__1 F__2

What is your marital status: S__1 M__2 D__3

What is your race: Caucasian ___1 Black___2 Hispanic___3 Asian___4

Please indicate your age: _____ years old

18 – 29 ____ 30 – 39 ____ 40 – 49 _____ 50 – 59 _____ 60 and older

Please indicate your household's annual income: $_____ per year

<=20,000 _____ ; 20,000 – 40,000 _____; 40,001 – 60,000 _____;
60,000 – 80,000 ____ ; >80,000 _____

APPENDIX B

Florida Department of Agriculture and Consumer Services

NEW OYSTER PRODUCT SURVEY

MARKETING

1a. Were you previously aware of the availability of this new low bacteria frozen oyster product?

Whole: Yes _____ No _____ (If no, go to question number six.)

Half-shell Yes _____ No _____

1b. If yes, are you currently offering the frozen oyster product in your product line?

Yes _____ No _____

At volume would best describe your buyers' demand for any type of oyster?

High _____ Medium _____ Low _____

2. What was the approximate total volume (number) of oysters that you purchased in 1999?

Dozens_____

3. Have you, or any of your business affiliates, experienced any problems with oysters within the last year (see below list of problems).

Short Shelf Life	Yes _____	No _____	Not Sure _____
Appearance	Yes _____	No _____	Not Sure _____
Grittiness	Yes _____	No _____	Not Sure _____
Food born illness	Yes _____	No _____	Not Sure _____

Other (please list): _____

4. If you do not currently offer oysters in your product line, please indicate the reasons from the list below (check all that apply):

Not sure where to get them_____ Profit margin too low _____
Unaware of proper handling and storage methods_____ Price to high _____
Not familiar with the market _____ Presence of food born illness (bacteria/virus) _____
Previous problems with product availability _____ No customer requests _____
Other (please list): _____

6a. If you currently sell oysters and offer a low bacteria content frozen oyster product that is labeled and promoted as such, what do estimate your increase in sales would be as compared to only offering raw oysters?

No increase in sales _____

10% _____ 50% _____

30% _____ 100% _____

6b. If an increase in sales, which low bacteria content frozen oyster would you prefer to buy/sell?

Whole_____ Half Shell _____ Other_____

7. Would you pay a premium price ($0.35/oyster) for low bacteria content frozen oysters?

Yes _____ No _____

8. Is there a certain time of year when oyster supply is low and you would purchase frozen low bacteria content oyster products?

Yes _____ No_____

Month(s)_____

9. For what reason would you purchase frozen low bacteria content oyster?

Seasonal availability _____ Storage _____

Shelf life _____ Other (specify)_____

STORAGE AND PACKAGING

10. What freezer capacity do you currently have for storing these frozen oysters?

Freezer Size_____

What interest would you have in a product with long shelf life to supplement your fresh oyster needs?

No interest _____ somewhat interested _____ strongly interested _____

11. Would you prefer your oysters:

Whole _____ Half Shell _____

For those checking half shell in question 11, skip to question 14b.

12. Please indicate your top three preferences for how you would like this new product packaged.

30 count box _____ 40 count box _____ 60 count box _____

60 lb sack _____ 100 lb sack _____

14a. For those preferring a 30, 40, or 60 count box. In order of preference would you prefer to receive whole frozen oysters:

Arranged on trays _____

Arranged on trays with a liner between the trays. _____

Packaged loosely w/o trays or liners _____

14b. Would you prefer to receive half shell oysters in a box with: Please number in order of preference

6 trays of 24 oysters per tray with no liner between. _____
6 trays of 24 oysters per tray with a bubble pack liner between each layer. _____
12 trays of 1 dozen oysters per tray with no liner between trays. _____
12 trays of 1 dozen oyster per tray with bubble pack liners between trays. _____
12 layers of 1 dozen oysters, each dozen arranged in a single layer with a bubble pack liner between each layer _____.

15. What size package would you prefer? Please number in order of preference.

Less Than 144/box _____ 144/box _____ Greater Than 144/box _____

16. Do you think consumers would be willing to buy specially packaged frozen oysters at supermarkets or other retail outlets?

Yes _____ No _____ Not Sure _____

CORPORATE

NOTE: INFORMATION SPECIFIC TO INDIVIDUAL COMPANIES PARTICIPATING IN THIS SURVEY WILL BE KEPT STRICTLY CONFIDENTIAL. THE CUMULATIVE RESULTS OF THE SURVEY WILL BE AVAILABLE TO ALL PARTICIPATING COMPANIES AT NO COST.

17. Check all that apply to your type of company:

Wholesaler _____
Food Service Buyer _____
Supermarket Buyer _____
Independent Retail Buyer _____
Other (please specify_____

18. How many employees does your company currently employ?

Full-time _____ Part-time _____

19a. Where is your business located?

City_____ State_____

19b. Which state(s) do you receive the most sales from? _____

Thank you for your interest and taking the time to help us with this survey.

If you are interested in additional information on the new frozen oyster product or the results of this survey, please check the appropriate line and fax your request to the number below or send your request by e-mail to

I would like to receive: Product Information _____ Survey Results _____

Return Complete Survey to:
Bureau of Seafood and Aquaculture Marketing
Florida Department of Agriculture and Consumer Services
2051 E. Dirac Drive
Tallahassee, FL 32310
Fax Number 850-922-3671

Your Name_____
Company_____
Address_____
City/State/Zip_____
Fax:_____

APPENDIX C

TRIANGLE TEST- DACS Oyster Project

November 14, 2000

Panelist #_____

Two of these samples are identical and one is different.

1. Taste samples in the order indicated below and identify the odd sample based on an overall difference. If you are not sure, take a guess.

Check the odd sample

1._____ _____

2._____ _____

3._____ _____

2. Please check the appropriate blank to indicate the degree of difference between the samples

Slight _____

Moderate _____

Large _____

3. Please describe the difference(s) you detected in quantitative terms of appearance, aroma, flavor and texture.

_____

_____

4. Acceptability. Please check only one.

Odd sample is more acceptable_____ Duplicate samples are more acceptable_____

5. Other Comments _____

_____

_____

APPENDIX D

Triangle Test Worksheet

Date:

Product:

Random Numbers

Product Codes: A –

B –

Order of Presentation:

Panelist		Random Numbers
1	7 13 19 25 31 37 43 49 55 61 67 73 79 85 91 97	A B B
2	8 14 20 26 32 38 44 50 56 62 68 74 80 86 92 98	B A A
3	9 15 21 27 33 39 45 51 57 63 69 75 81 87 93 99	A A B
4	10 16 22 28 34 40 46 52 58 64 70 76 82 88 94 100	B B A
5	11 17 23 29 35 41 47 53 59 65 71 77 83 89 95	A B A
6	12 18 24 30 36 42 48 54 60 66 72 78 84 90 96	B A B

Instructions:

Product Temperature –

Lighting --

Other --

APPENDIX E

Participant Demographics

Respondent Gender		
Gender	Number	Percentage
Female	23	34 %
Male	44	66 %
Total:	**67**	**100 %**

Respondent Age		
Age	Number	Percentage
18-34	54	81 %
35-44	5	7.5 %
45-54	5	7.5 %
55-60	1	1 %
Over 60	2	3 %
Total:	**67**	**100%**

Household Income		
Income	Number	Percentage
Under $20,000	51	76 %
$20-$35,000	9	13.5 %
$36-$50,000	2	3 %
$51-$75,000	1	1.5 %
Over $75,000	4	6 %
Total:	**67**	**100%**

Employment		
Employed	Number	Percentage
Yes	44	66 %
No	23	34 %
Total:	**67**	**100 %**

Respondent Household Size		
Household Size	Number	Percentage
One	11	16.5 %
Two	24	36 %
Three	20	30 %
Four	11	16 %
Five	1	1.5 %
Six or More	0	0 %
Total:	**67**	**100 %**

Frequency of Oysters Consumption at Home		
Frequency	Number	Percentage
Never	38	57 %
Once Every 6 Months	18	27 %
Once Every 3 Months	8	12 %
Two times a Month	3	4 %
Once a Week	0	0 %
Total:	**67**	**100%**

Frequency of Oysters Consumption at Restaurant		
Frequency	Number	Percentage
Never	17	25 %
Once Every 6 Months	31	46.5 %
Once Every 3 Months	16	24.5 %
Two times a Month	3	4 %
Once a Week	0	0 %
Total:	**67**	**100 %**

Participant Preference		
Type	Number	Percentage
Raw	37	55 %
Cooked	30	45 %
Total:	**67**	**100 %**

Respondent Race		
Race	Number	Percentage
White	38	57 %
Black	14	21 %
Native American	2	3 %
Asian or Pacific Islander	5	7.5 %
Hispanic Origin	5	7.5 %
White Hispanic Origin	3	4 %
Total:	**100**	**100 %**

APPENDIX F

FOR IMMEDIATE RELEASE
INFORMATION:
Paul Balthrop
(850) 488-0163

FRESH OR FROZEN…YOU BE THE JUDGE

Can you tell the difference? Whether it's a fresh oyster right out of the water, or one that was previously frozen, some people say they cannot tell the difference. Which do you prefer?

Evaluating the potential significant differences between fresh and previously frozen raw oysters is an integral part of a collaborative effort between the Florida Department of Agriculture and Consumer Services, Bureau of Seafood and Aquaculture Marketing and the University of Florida Sea Grant College Program.

The University of Florida Institute of Food and Agricultural Science laboratory performed taste tests on the new frozen oyster products to determine consumer preference. To be accurate, all samples were harvested 48 hours prior to the test from the same location in the Gulf of Mexico. The frozen oysters were processed by manually removing the top shell, then individually freezing, glazing, packing and storing at –10°C for 21 days. Consumers tasted variable combinations of three oysters (fresh and frozen) and were asked to distinguish the taste differences.

It was concluded from this taste test that people can distinguish fresh oysters from similar previously frozen oysters. However, there was no clear-cut preference. Both products were accepted and/or preferred equally. Fresh oysters had a "more salty" or "very salty flavor", fresh or oceanic flavor, less chewy texture, and had a better appearance. Frozen oysters had a less salty flavor, a sweeter taste and texture, were more firm and/or chewier, and had a fishy smell.

The Bureau of Seafood and Aquaculture Marketing will publish the final results of this research in a comprehensive report, which will be made available on the internet and as printed material.

Consumers and buyers can e-mail their questions about oysters and this new product to oysters@doacs.state.fl.us. Consumers can also request a colorful brochure containing cooking tips, recipes and proper care and handling of oysters by writing Paul Balthrop at the Bureau of Seafood and Aquaculture, 2051 East Dirac Drive, Tallahassee, Fl 32310 or e-mail balthrp@doacs.state.fl.us. Please refer to Oyster/NE when sending requests for this brochure.

APPENDIX G

FOR IMMEDIATE RELEASE
INFORMATION:
April 13, 2001
Paul Balthrop
(850) 488-0163

ARE YOU CONCERNED?

Worried about eating raw oysters? Well, peace of mind may be right around the corner. The Florida Department of Agriculture and Consumer Services, Bureau of Seafood and Aquaculture, through a grant from the Sea Grant College Program at the University of Florida and in cooperation with the Gulf Oyster Industry Council, is working to further the study and marketability of a safer oyster.

This new product which, when exposed to extremely low temperatures for specific periods of time, shows no detectable signs of the bacteria *Vibrio vulnificus*.

This is not to say that eating oysters is risk free. A small number of people with pre-existing health conditions are at risk due to the potential for raw oysters to carry *Vibrio vulnificus*, which occurs naturally in coastal water oysters. If you are unsure about whether you may be at risk, please consult your physician.

Thanks to the research done by Drs. Gary Rodrick and Steve Otwell at the University of Florida Sea Grant Program, help could be on the way. Florida Sea Grant found that after three weeks of storage at extremely low temperatures there are no detectable bacteria remaining in the oyster.

Dr. David Zimet and his staff at the University of Florida's extension office in Quincy, Florida also conducted a survey to judge consumer interest in this new product. Dr. Zimet's survey indicated that 32% of the respondents that liked to eat oysters, showed interest in oysters with non-detectable bacteria levels. The survey also indicated that those respondents who believe the new method of freezing oysters can reduce the bacteria levels are more likely to purchase this new product and would be willing to pay a premium price.

On site interviews with major buyers throughout Florida and at the 2000 International Boston Seafood Show were conducted to determine if the frozen oysters would be accepted in the open market. The results of these interviews indicated that price and consumer acceptance would be primary considerations in determining future sales. Buyers will be educated about the results of the research at this year's Boston Show. The University of Florida also conducted a taste test on this new product and found no clear-cut preference for either frozen or fresh oysters.

Consumers and buyers can e-mail their questions about oysters and this new product to oysters@doacs.state.fl.us. Consumers can also request a colorful brochure containing cooking tips, recipes and proper care and handling of oysters by writing Paul Balthrop at the Bureau of Seafood and Aquaculture, 2051 East Dirac Drive, Tallahassee, Fl 32310 or e-mail balthrp@doacs.state.fl.us. Refer to Oyster/NW when sending requests for this brochure.

APPENDIX H

FOR IMMEDIATE RELEASE
INFORMATION:
April 25, 2001
Paul Balthrop
(850) 488-0163

YOU CHOOSE.

Current and future trends in the oyster industry have been determined and research on developing a safer oyster is complete. The Florida Department of Agriculture and Consumer Services and the University of Florida have been working together on marketing and research of this new frozen oyster product.

Dr. Gary Rodrick at the University of Florida researched and determined the initial load of *Vibrio vulnificus* in oysters harvested in Florida and Louisiana and to obtain the number of *V. vulnificus* in frozen oyster samples held for 1, 7, 14, 21 and 28 days at –10°C. *Vibrio vulnificus* is a naturally occurring bacteria in coastal waters that is concentrated in oysters. Dr. Rodrick wanted to compare the effectiveness of CO_2, nitrogen, and blast freezing in lowering the *V. vulnificus* load, as well as, compare the effectiveness of freezing whole oysters versus oysters on the half shell. Oysters were obtained from, and frozen in, various processing plants in Florida. A control group was set aside in order to obtain the initial *V. vulnificus* load of the oyster meat. Where possible the oysters were separated into whole oyster and half shell oyster lots for freezing. At the end of the 28 day (and sometimes 21 day) period there was no detectable *Vibrio vulnificus* in the samples.

Dr. David Zimet a cooperative extension agent with the University of Florida research facility in Quincy, Florida performed a survey to determine the marketability of this new frozen oyster to consumers. He also compiled the results of a nationwide survey performed by the Florida Department of Agriculture and Consumer services which was designed to gauge how seafood buyers might react to this new product. The two surveys were divided up into five regions: Gulf Coast, Atlantic Southeast, Atlantic northeast, the Pacific coast, Alaska and Hawaii, and the rest of the country. The country was divided this way because the majority of the oyster consumption takes place in the coastal areas.

The following are some of the findings of the trade survey:

- 31% of the trade survey respondents were aware of availability of frozen oysters.
- 60% of the respondents expressed a preference for frozen oysters on the half shell.
- Shelf life, appearance and food borne illness did not appear to be significant issues with buyers. Grittiness was an issue.
- Volume demand was described as: Low – 35% Med. – 50% High – 15%
- 65% indicated they would pay a premium for frozen oysters.
- Respondents offering frozen oysters more likely to pay a $0.35 premium per oyster.
- The Gulf Coast and Southeast regions were more likely to pay a premium than rest of country.

The consumer survey performed by Dr. Zimet produced the following results:

- 71% aware of dangers of eating raw oysters.
- 28% would eat more oysters if health concerns were reduced.
- Only 31% believed the statement that a new method of freezing oysters kills harmful bacteria.
- 32% expressed an interest in such a product.
- Respondents who believe the new method of freezing oysters reduces bacteria are more likely to purchase frozen oysters.
- Respondents who believe the new method of freezing oysters reduces bacteria are willing to pay more for frozen oysters.

The Bureau of Seafood and Aquaculture Marketing will publish the final results in a comprehensive report, which will be made available on the internet and as printed material.

Consumers can request a colorful brochure containing cooking tips, recipes and proper care and handling of oysters by writing the Bureau of Seafood and Aquaculture, 2051 East Dirac Drive, Tallahassee, Fl 32310 or e-mail the Bureau at Recipes are also available on the Bureau's website: Please refer to Oyster/CT when sending requests for this brochure.

APPENDIX I

Are Frozen Oysters On the Way?

By Kimberlie Clyma
MeatSeaKC@aol.com

Research examines whether there's a demand for frozen oysters in retail market

Most consumers are aware of the health risks of eating raw oysters. According to a study by the University of Florida, many consumers say they would eat more oysters if the health risks were reduced.

Vibrio vulnificus is a bacterium that occurs naturally in marine waters and is commonly found in oysters. *Vibrio* can cause illness and death for some who consume raw oysters. Freezing oysters to kill the bacterium is one way suppliers are trying to reduce the risk. But will consumers want to purchase frozen oysters instead of fresh?

The oyster study, conducted by the Department of Agriculture and Consumer Services and the University of Florida, was designed to gauge the feasibility of marketing frozen oysters in supermarkets. Researchers surveyed both consumers and people in the supermarket industry.

Of the 2,863 consumers surveyed, 1,800 (62.9%) ate oysters. The reasons cited for not liking oysters were: don't like the taste, thought they were slimy and didn't like the appearance. Seventy-one percent were aware of the dangers of eating raw oysters and 28% would eat more if health risks were reduced. Thirty-two percent expressed interest in frozen oysters after hearing that they could reduce the health risks.

The study showed that the typical oyster consumer is male, between the ages of 18 and 49, who lives in a coastal area and earns more than $60,000 per year. Consumers with incomes above $60,000 were more willing to pay more for frozen oysters.

As for the 525 respondents from the supermarket trade, 31% were aware of the availability of frozen oysters.

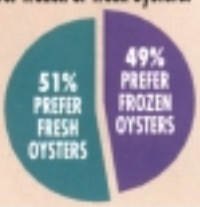
Sixty-five percent would pay a premium amount for frozen oysters (most of the 65% were from the coasts).

The main reasons buyers said they would buy frozen oysters would be for seasonal availability (38%) and shelf life (44%). Health issues were not of high concern to retail buyers.

Another part of the study involved a consumer taste test between fresh and frozen oysters. The taste comparison found that although the consumers could tell the difference between fresh and frozen oysters, they didn't show a preference (49% preferred the frozen and 51% preferred the fresh). UM

No preference

In a consumer taste test there was no significant preference over frozen or fresh oysters.



Raw oysters are very popular with consumers, however, they can be a health risk. Studies show that freezing raw oysters may help prevent health risks. A University of Florida study showed that consumers would be willing to try frozen oysters if they would reduce health risks.

NOTES: