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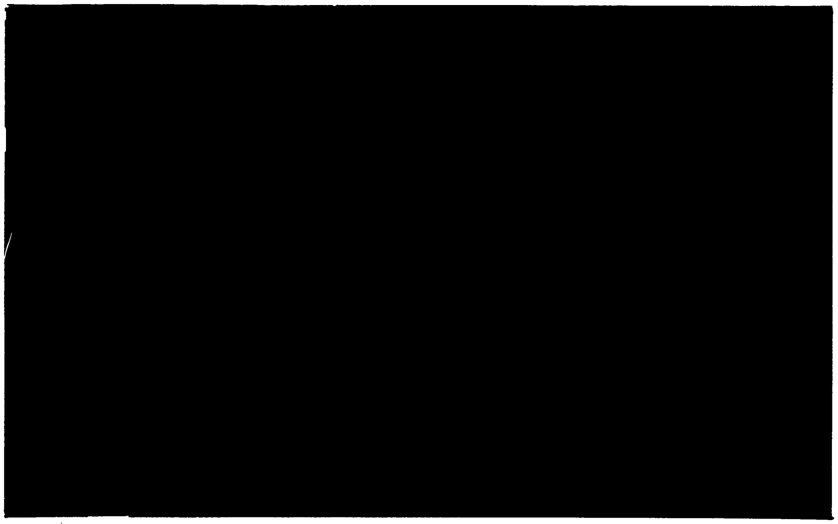
SYMONS HALL
UNIVERSITY OF MARYLAND
COLLEGE PARK 20742



AN ANALYSIS OF THE U.S. DEMAND FOR SEAFOOD AND IMPLICATIONS FOR SUCCESSFUL AQUACULTURE

by

Amy R. Buss and Ivar E. Strand

Department of Agricultural and Resource Economics
University of Maryland
College Park, Maryland 20742

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INTRODUCTION

The United States seafood market in recent years has been characterized by increasing demand coupled with lowered yields from domestic capture fisheries. As a result, imports of aquaculturally produced goods have made up an increasing proportion of the supply of domestically consumed fish. While precise statistics are difficult to obtain, it appears clear that much of the increase in domestic consumption of seafood is being provided by foreign aquaculture producers. For example, U.S. consumption of shrimp in the 1980's rose by 80%, three-quarters of which was met through foreign supply. During this period, aquaculture's share of world shrimp supply rose from nearly nothing to 26%. Another example is salmon, whose imports from Norway have risen from less than one thousand metric tons (KMT) in 1982 to nearly 10 KMT in 1988 (U.S. Dept. of Commerce).

Aquacultural production in foreign countries has been comprised of highly valued species, such as salmon and shrimp, while the United States' aquaculture production has been dominated by southeastern production of catfish and crawfish, both lower valued species. Other species being domestically cropped in reasonable amounts include salmon in the Pacific Northwest and in Maine; trout in the Midwest and Southwest; shrimp in Florida; oysters and clams in the Northeast, Mid-Atlantic and the Gulf; and hybrid striped bass in the Mid- and South Atlantic states. However, in most cases, these pockets of aquacultural development are still in experimental phases and cannot be compared with the organized production and marketing schedules of foreign aquaculture.

Domestic aquaculturists' proximity to the domestic markets gives them a locational comparative advantage in the production of a fresh, highly valued product which can be easily supplied to high income, population centers. Yet a significant constraint to aquaculturists is the limited information which exists on outlets for their products. Much of the emphasis in research on aquaculture thus far has been directed toward the actual production of various species rather than on prices and consumer demand for the product.

Although some literature exists, little effort has been directed to examining the consumers purchases of seafood, the location of consumption (at-home or away-from-home), or the socio-demographics of seafood consumers. The information would be useful to aquaculture producers, wholesalers and retailers. The away-from-home market is particularly relevant as it is believed that restaurants will pay a premium for a consistent supply of fresh fish. Detailed information on the nature of consumer preferences for seafood should help aquaculturists identify and target specific markets within which they can promote their product.

The purpose of this paper is to examine the demand for several seafood items eaten at and away-from-home. Choices made by consumers in retail purchases of seafood and in entree selections at restaurants are analyzed in order to characterize consumer preferences for several potential aquaculture products. Purchases of trout and catfish at retail outlets and the selection of lobster, shrimp, oysters and clams at restaurants are analyzed. The effects of price, regional preferences, ethnicity, household size and income are considered.

Of particular interest to us is the role that household income plays in determining the responsiveness of consumers to price. This is important because aquacultural producers may increase their markets through lower prices, promotion, or both. Targeting price changes to groups who respond to them or advertizing to groups pre-disposed to the product may improve the effectiveness of the strategy. Knowledge of price responsiveness and product receptivity is fundamental to effective promotion strategies.

PAST SEAFOOD DEMAND STUDIES

Our knowledge of consumer preferences for aquaculturally-produced species is evolving. Most studies of aquaculture have focused on technical aspects of production of various species , on the economic feasibility of aquaculture ventures, or on the interaction between capture fishery and aquaculture products at the wholesale or ex-vessel level.

Much of the literature on the demand for aquaculturally-produced species has been accomplished without direct contact with consumers. Interviews with wholesalers and retailers (e.g. salmon-Anderson; striped bass- Swartz and Lipton) have given understanding of the preferences of middlemen. Others have used information on aggregate production and prices to infer wholesale demand. Hermann and Lin (1988), for example, used a simultaneous equation model to examine the aggregate supply and demand of Norwegian Atlantic salmon. They found that demand for this salmon species is highly seasonal, price and income elastic, both in the United States and in the European Community.

Analysis of Seafood Consumption

Despite the evolutionary stage of aquacultural analysis, seafood consumption has been the focus of several recent studies. Hu (1985) used information directly obtained from consumers to summarize trends in seafood consumption both at-home (AH) and away-from-home (AFH) based on surveys conducted in 1970, 1974, 1978, and 1981. While he did not use statistical analysis to determine changes in seafood consumption patterns throughout time, he was able to demonstrate differences in per capita consumption of seafood species between individuals from different income groups, regions, religions and races. Hu found that the higher the income level, the higher the percentage of seafood eaten AFH. More shellfish than finfish is eaten AFH relative to at-home consumption. He noted that individuals from urban areas consume less finfish but more shellfish AFH than rural individuals. Education was positively related to the percent of shellfish eaten AFH versus at-home.

Cheng and Capps (1988) have examined at-home seafood demand through an analysis of household expenditures on three shellfish and five finfish species. Sociodemographic variables such as household income, household size, geographic location, occupation, education, and age, as well as own-price, substitute price, and seasonality, were considered simultaneously. They found that household size and own-price of particular species are key factors in explaining variation, while cross-price effects between seafood and red meat and poultry were generally insignificant. They report own-price elasticities ranging from -.45 for flounder to -1.13 for oysters. Price elasticities for total finfish and total shellfish were found to be -.68 and -.88 respectively. Cheng and Capps found income elasticities in the at-home market to be insignificant except for crabs, oysters and total finfish. They also reported that household size generally has a significant positive influence on finfish consumption but insignificant for shellfish.

They concluded that should U.S. supply of seafood increase (e.g. through aquaculture), the marketing channels through which the product would flow could not be evaluated without an analysis of the away-from-home market for seafood. No study to date has analyzed the away-from-home demand for disaggregated fishery products.

Analysis of Away-From-Home Food Consumption

While the demand for seafood consumed away-from-home has not been researched, a structure for analyzing expenditures on or consumption of food-away-from-home exists. Sexauer (1979) attempted to "quantify the degree to which aggregate expenditure on AFH depends on the distribution of income and of households among population subgroups." He looked at changes in annual AFH expenditures over time as a function of family size, age, urbanization, education, sex, presence of a working wife, income, and income crossed with all of the above. He concluded that demographic shifts accounted for 22.3% of the observed change in average household expenditure over the period examined. One implication of this study for seafood demand analysis is that increased seafood consumption in the last decade may not be, after all, the result of more health-conscious consumers, but just demographic changes in the U.S. population. Identification of the demographic variables most significantly contributing to the increased consumption may be useful to aquaculturists.

McCracken and Brandt (1987) used a household production approach to look at expenditures on AFH by type of food facility. They decompose their estimates of the effects of household size, income and the value of the food manager's time into expenditure elasticities with two components, a "conditional elasticity associated with actual expenditure and the elasticity of the probability of consumption." They report that the market participation elasticity (elasticity of probability of consuming) overshadows the conditional quantity response in almost all participation, and thus conclude that advertising or marketing schemes should focus on consumers at the extensive margin.

METHODOLOGY

Seafood is a food that may be purchased infrequently, if at all, relative to purchases of other food items by an individual. For example, seafood consumption during the summer of 1985 represented less than 10 % of the total daily intake of meat, poultry and fish (USDA). Thus, many sample respondents observed over a sampling period may consume seafood only once or not at all. When the category of seafood is subdivided into particular seafood products or species, the probability of observing zero consumption is even greater.

This fact has several implications for our analysis. First, one must obtain a large sample in order to observe a reasonable number of individuals who consume a species. Second, most samples will have numerous individuals who have not consumed the item during a sampling period. To use the information concerning non-consumers in deriving price responsiveness, a "relevant" price for the non-consumers must be obtained. Finally, neoclassical economics and most standard econometric models must be modified to deal with zero and non-negative consumption. The next section presents the theoretical and econometric models used in our analysis. The commonality among the models is that they reflect the reality of limited consumption.

Away-from-home demand (AFH)

In order to describe the away-from-home demand for seafood, seafood consumption is conceptualized as a random event, occurring infrequently in a short, fixed interval of time. The distribution of the random event is dependent on the characteristics of the household and market. Additionally, the purchaser at a restaurant normally does not have to choose the amount of the item offered on the entree. Thus, the purchaser's decision is discrete, either the entree is selected or it is not. With this in mind, a Poisson model was deemed an appropriate framework within which to analyze monthly away-from-home demand for seafood AFH, with the discrete random event being the number of times per month an individual chooses a seafood item.

The Poisson distribution is characterized by the probability distribution function

$$Pr(\, Y_i = q \,) = \frac{e^{-\lambda_i} \lambda_i^q}{q\,!} \tag{1}$$

where Y_i is a discrete, nonnegative random variable whose distribution is described, for the i^{th} individual by parameter λ_i . A Poisson process is one which generates a number of changes in a fixed interval of time, and the number of changes in nonoverlapping intervals are independent (Hogg and Craig). In this phase of analysis, Y_i represents the total number of times in one month that the i^{th} household head selects a seafood species as an entree. If we assume that the log of λ_i is linearly dependent on a vector of explanatory variables (Z_{ij}), then

$$\ln \lambda_i = \beta_0 + \sum_{j=1}^{J} \beta_j Z_{ij} \qquad \textit{for all} \quad \lambda_i > 0 \tag{2}$$

and the log of the likelihood function for a sample of I consumers is:

$$\ln L = -\sum_{i=1}^{I} \lambda_i + \beta_0 \sum_{i=1}^{I} Y_i + \sum_{j=1}^{J} \beta_j \sum_{i=1}^{I} Z_{ij}\, Y_i - \sum_{i=1}^{I} \ln\,(Y_i!) \tag{3}$$

Once the coefficients are recovered, λ_i is easily calculated, since

$$\hat{\lambda}_i = \exp\,(\,\hat{\beta}_0 + \sum_{j=1}^{J} \hat{\beta}_j\, Z_{ij}) \tag{4}$$

One should note that equation (2) is the discrete analog of a semi-log demand function. The consumption variable is the number of times during a fixed interval that a household head chooses a specific entree away from home. In this application, we have chosen to allow the mean of the distribution, λ, to be dependent on entree's price and on the ratio of the entree's price to the income of the household. The mean number of times, λ_i, is continuous and we can obtain an elasticity of it with respect to price as:

$$\xi_i = \beta_1 P + \beta_2 P/I \tag{5}$$

This particular specification allows for the possibility that price elasticity will depend on the level of household income.

At-home Demand

The choice to purchase seafood for consumption at home is different than the away-from-home decision. Most fundamentally, the entire family is considered in the purchaser's decision and amount of purchase can vary continuously. Away-from-home decisions are largely individual whereas food cooked at home is normally prepared for everyone in the family. Hence, factors associated with the family become important in the analysis.

Secondly, the shopper can usually determine the amount (volume) that will be purchased and prepared. But there is an at-home discrete choice that lies with the decision whether or not to purchase the item. Conditional on that decision, the shopper makes a decision (continuous) as to how much to purchase. While the entire choice problem contains a discrete and continuous portion, we have chosen to focus on the continuous portion of the decision. The amount purchased by the i^{th} respondent (x_i) on a given shopping trip , given that the respondent purchases the product, is our subject and is given by:

$$E(x_i|x_i>0) = \beta_0 + \beta_1 * Z_{i1} + \sigma_u h((\beta_0 + \beta_1 Z_{i1})/\sigma_u) \tag{6}$$

where x_i is the log of the quantity purchased, Z_{i1} is a vector of factors influencing the amount purchased, σ_u is the standard error of the regression and h(.) is the ratio of the standard normal density function to the standard normal cumulative function (see Maddala for a description of the truncated normal distribution).

DATA DESCRIPTION

The data used in this analysis were collected by Market Research Corporation of America (MRCA) for the U.S. National Marine Fisheries Service (NMFS). MRCA conducted a survey of 7,500 households and 12,000 individuals from December of 1980 to January of 1982. The data included household purchases of seafood for at-home consumption and daily records of individual seafood consumption both at and away-from-home. The purchase data is given on a per shopping trip basis and the sample runs continuously for 48 of the 52 weeks of 1981. In addition to the amount purchased, information is given on the product form (i. e. iced, fresh, whole, fillets, canned) and cost of the purchase. Sociodemographic information for each household and for the household head includes state of residence, metro area size, number of members in the household, household income, age, occupation and education level of the household head, race, and religion.

A daily consumption survey was also filled out by the household head for one month in each quarter. Information on AFH consumption includes the type of place at which the seafood was consumed, the date of consumption, the time of day at which the seafood was consumed, the way in which the meal was prepared or served, the quantity consumed, the course in which the item was consumed (e.g., as a main dish or appetizer), and the actual species chosen by the individual.

Data Used for AFH Demand:

To concentrate the AFH consumption data into our model, only observations on the household head were considered because certain sociodemographics could only be recovered for this member of the household. An observation was used only if the meal eaten was recorded as a "main dish"; i.e., appetizers, soups, or snacks were not included. Actual quantity consumed was not used as an explanatory variable or to impute a meal price due to extreme variability in recorded quantities.

The price per pound for each species was determined from MRCA purchase data on seafood bought for at-home consumption. A purchase price, which could be considered a retail price, was calculated as the average price per pound paid by month by households in the ten East Coast states identified previously. Since monthly demand was estimated, the average monthly retail price per pound was deemed a sufficient proxy for restaurant meal price. The notion behind using the monthly retail price is that the restaurant will have to pay a similar price for its product and the entree price will likely reflect the restaurants costs.

The data used to estimate each individual species Poisson model were based on observations of individuals from fifteen East Coast states and the District of Columbia (Maine, New Hampshire, Vermont, Rhode Island, Massachusetts, New York, New Jersey, Connecticut, Maryland, Virginia, District of Columbia, Delaware, North and South Carolina, Georgia, and Florida). Four regions were defined: R_1 = New England (Maine, New Hampshire, Vermont, Rhode Island, Massachusetts); R_2 = New York Sphere (New York, New Jersey, Connecticut); R_3 = Middle Atlantic (Maryland, Virginia, District of Columbia, Delaware); and South (North and South Carolina, Georgia, Florida).

The monthly demand for four shellfish species (shrimp, lobster, oysters, and clams) was estimated. Observations of zero consumption were inferred if a household did not report any consumption of the particular species within a month of survey. The total number of households in this sample is 1,662.

RESULTS

AFH Demand for Shellfish:

In the models of individual species demand, all AFH models are specified as:

$$\ln \lambda_j = \beta_0 + \beta_1 PRICE + \beta_2 PRICE/INCOME + \beta_3 EDUC + \sum_{j=1}^{3} \beta_{j+3} R_j \tag{7}$$

where PRICE is the monthly average retail price per pound for individuals (in the MRCA purchase diary data set) who purchased the species, INCOME is the household's annual gross income, EDUC is the household head's years of formal education, and the R_j are binary variables denoting the region associated with the household head's residence.

The four regressions are interpreted as monthly demand equations for particular species as functions of own-price, price-income interaction, and sociodemographic descriptors. The coefficients reflect the influence of the associated variable on the mean number of times a particular species is selected as an away-from-home entree in one month. The results (Table I) were obtained using LIMDEP, Version 5.1 (Greene, 1989) on an IBM 4381 computer. The species are ordered from left to right according to the mean (λ) of their Poisson distribution (evaluated for the 'representative household head'). The average times per month for shrimp was .066 whereas oysters was .002. Thus, if one observed 1000 repondents over one month, one could expect sixty-six shrimp entrees to be chosen but only two oyster entrees.

The coefficients on the PRICE variable are all insignificant at the 5 % level of confidence. There are several potential reasons for this: 1.) the use of retail prices is inappropriate for AFH decisions; 2.) there is not sufficient variation in PRICE, particularly when the PRICE/INCOME variable is also included in the regression; and 3.) the influence of price on AFH decisions for these species is best captured by considering PRICE interacting with INCOME. The first explanation was examined when we tried alternative specifications of equation (7). In all cases, the PRICE variable was negative and significant when the PRICE/INCOME variable was not used. This is supportive of rejecting the first explanation. We have no way of addressing explanation (2), but we can say something about the PRICE/INCOME interaction.

All coefficients associated with the PRICE/INCOME variable were negative and significantly different from zero at the 5 % level of confidence. The least reponsive seafood to this variable was shrimp whereas the most responsive were clams. For the most part, the size of is strongly correlated, across species, with the mean of the distribution, λ. The consistency of the results, combined with the intuitive logic of including it, suggests that our

Table I: Away-from-home Monthly Demand for Seafood, by Species

	Species's Coefficients			
Variables	**Shrimp**	**Lobster**	**Oyster**	**Clams**
Price	-0.17 (-1.33)[a]	-0.06 (-0.88)	0.21 (1.73)	0.33 (1.06)
Price/Income[b]	-1.093 (4.46)*	-1.639 (-2.85)*	-3.017 (-3.63)*	-5.812 (-3.99)*
Education, HH head	0.085 (5.60)*	0.110 (3.56)*	0.036 (1.19)	0.233 (0.75)
Rural area	-0.460 (-3.30)*	-0.906 (-2.43)*	0.892 (4.08)*	-0.755 (-2.24)*
Suburban area	0.078 (0.72)	-0.105 (-0.43)	0.604 (2.62)*	-0.176 (-0.74)
New England	-0.192 (-1.06)	0.673 (2.21)*	-1.463 (-3.93)*	1.299 (4.58)*
New York Sphere	-0.533 (-3.85)*	0.607 (2.37)*	-2.076 (-6.64)*	0.069 (0.25)
Middle Atlantic	-0.432 (-2.90)*	0.405 (1.25)	-0.612 (-2.30)*	-0.452 (-1.15)
Constant	-2.17	-5.00	-6.96	-4.82
**************************				
λ-mean #/month	.066	.014	.002	.009
Mean price/lb.	$4.99/lb	$5.46/lb	$3.56/lb	$2.37/lb

[a] Asymptotic t-ratios in parentheses. [b] Income measured in thousands of dollars.
* Denotes significance at the 10 % level, 2-tailed test.

explanation (3) cannot be easily dismissed.

The individual's education had a positive and significant effect on consumption of shrimp and lobsters; however, oyster and clam coefficients, although positive, were not significantly different from zero. The positive effect could arise from education exposing the individuals to the nutritional value of seafood. Also, it could be related with the person's parental income. Greater parental income leads to greater education and also effects the individual's exposure to seafood, goods that are normally positively related to income.

Urbanization was expected to have a positive effect on the AFH demand for shellfish because the majority of East Coast urban areas are close to the ocean and individuals living there should have greater access to seafood. Rural residents were estimated to choose lobster, shrimp and clams less frequently, while choosing oysters more frequently. Also, suburban residency positively affected the demand for oysters. Thus, oyster selections were somewhat of a anomaly, increasing as one moves further from the urban center.

Finally, the regional variation was expected to be a factor determining demand for shellfish, primarily due to regional preferences. The results support most of the expectations. All comparisons are with individuals residing in the South region. New Englanders were found to exhibit a relatively stronger demand for lobsters and clams, while they were less likely to choose oysters. Individuals in the New York/New Jersey/Connecticut region showed strong preferences for lobsters and were less likely to choose shrimp and oysters. Individuals from the Maryland-Virginia region (here referred to as Middle Atlantic) were more likely to consume lobsters and less likely to consume shrimp and oysters.

At-Home Demand for Finfish

Household purchases of finfish (trout and catfish) for the AH models are specified as:

$$\ln(x_k) = \beta_0 + \beta_1 PRICE_k + \beta_2 (PRICE/INCOME)_k + \beta_3 WGT + \beta_4 SIZ + \sum_{j=1}^{3} \beta_{j+4} R_j \tag{8}$$

where the new variables are x_i (the pounds purchased of species i), WGT (the purchaser's weight in pounds), SIZ (the number of persons in the household), and BLK (a binary variable reflecting whether the household identified itself as black). The new variables reflect the household nature of the purchase and the continuous nature of the purchase. It should also be noted that the price variables here are specific to the individual household that purchase the finfish, not monthly sample averages that were used in the AFH analysis.

The regressions can be interpreted as semi-log demands for the three finfish species during shopping trips on which the shopper purchased the species. This demand is substantially more conditional than the AFH model because of the nature of the data. Thus, the change in demand can only arise during one shopping trip, not over the course of a month. The results (Table II) were obtained using the truncation procedure in LIMDEP.

As opposed to the shellfish AFH demand functions, all PRICE coefficients were negative and significantly different from zero. The difference may arise from the closer link between the individual agent and the price variable. The largest response was for trout, followed by catfish. Elasticities for these species depend on price and income and therefore are not compared here but rather left for the discussion section.

When the coefficients on the PRICE/INCOME variable are considered, the results are

Table II: Demand for Seafood Purchases, by Species

Variable	Species's Coefficients: Catfish	Trout
Price	-0.34	-0.50
	(-11.00)[a]*	(-5.35)*
Price/Income[b]	-0.077	-0.399
	(-0.39)	(-0.50)
Purchaser's Weight (lbs)	0.0022	-0.0004
	(2.19)*	(-0.17)
Household Size	0.0745	0.015
	(3.81)*	(0.23)
Ethnicity	0.332	c
	(4.52)*	
New England	-0.25	d
	(-0.30)	
New York Sphere	-0.41	0.269
	(-1.35)	(1.28)
Mid-Atlantic	d	0.65
		(3.91)*
Constant	0.68	1.59
σ	0.700	0.614
	(34.32)	(13.96)
Observations	536	106
Mean price/lb	$1.77/lb	$1.92/lb

[a] Asymptotic t-ratios in parentheses. [b] Income measured in thousands of dollars.
[c]Not included in equation. [d] No variation for sample.
* denotes significance at the 10 % level, 2-tailed test.

again substantially different than the AFH demands. Both finfish species have insignificant coefficients. Thus, it would appear that income is less important in the at-home purchase decision that the away-from-home entree choice decision.

Household characteristics variables were important determinants of catfish purchases. Both household size and the weight of the individual making the purchase lead to greater volume of purchase. The effect of each variable depends on the level of the other factors, but we can compute the marginal effect for the "representative" decision by setting the other factor at their mean value. When this is done, the effect of one more household member is .16 pounds more purchase whereas the effect of one-hundred more pounds of weight on the purchaser (going from the average of 176 lbs to 276 lbs) is .5 pounds per purchase. The black racial identification lead to greater catfish purchases. The insignificance of the household variables on the trout demand may be reflecting the small sample size of purchasers of trout.

Because the AH sample included the entire U.S., the regional residence coefficients reflect difference with regard to the rest of the nation, not just the South population as we had in the AFH analysis. The only significant regional factor was the Del/Md/DC/Va region, which had significantly greater purchases of trout than the rest of the country.

DISCUSSION

The most interesting result of our analyses centers on the contrast between the price responsiveness of the away-from-home consumer and the at-home consumer. While the analysis is admittedly preliminary, clear distinctions emerge. In particular, the results indicate that away-from-home price response is strongly dependent on the household's income whereas the at-home price response is not. To examine this further, we have computed own-price elasticities for each of the AFH and AH species and for four household income levels (Table III). The range in household income was chosen to be representative of the sample.

At $10,000 annual household income, the away-from-home elasticities are larger than the at-home elasticities, with the exception of shrimp. Thus, low income households will be more attracted to price reductions in away-from-home seafood items. However, if annual household income rises to $30,000, the AFH price response falls below the AH level in nearly all cases. At this level, the AH purchases become more responsive to price. For very high household incomes, the price elasticity of AFH items approaches zero. High income household heads behave as we might expect, they are unresponsive to price.

Because the work is still in progress, there are many shortcomings of the analysis and caveats that must be expressed with regard to these comparisons. The most obvious flaw in the comparison of the AFH and AH analyses is the existence of several factors which are not "controlled" between the experiments. The species examined in the at-home analyses are not the same species as in the away-from-home analyses. Indeed, one group is finfish and the other shellfish. Also, the decision environment varied from a period of one month with the AFH to the period of a shopping trip for the AH. Finally, one sample contained only

Table III: Effect of Income on Price Elasticity for Shellfish and Finfish

	Income Level			
	$10,000	$30,000	$60,000	$120,000
	Price Elasticity			
At-home Species:				
Catfish	-0.60	-0.60	-0.60	-0.60
Trout	-0.96	-0.96	-0.96	-0.96
Away-from-Home Species:				
Shrimp	-0.54	-0.18	-0.09	-0.05
Lobster	-3.18	-1.06	-0.53	-0.26
Clams	-1.38	-0.46	-0.23	-0.11
Oysters	-1.07	-0.36	-0.18	-0.09

participants and the other contained both participants and non-participants.

To some degree, the "uncontrolled" factors were sought. That is, when we found the results associated with the AFH model, we sought aquacultured species that might give us the opposite results from our original AFH analyses. Our choices of species and sample was experimental in the sense that we wanted to get results contrary to the AFH analysis. Now that we have found that differences are possible, we intend to explore the subleties of AFH and AH consumption of these items in a more controlled fashion.

SUMMARY

Despite the pitfalls of the analyses, there are several useful results that we believe are worth pursuing. First, the use of retail prices in AFH decision models may be an avenue for exploring price responsiveness in AFH demand. There are tremendous difficulties in analyzing AFH seafood consumption, including controlling for variations in quality and the packaging of several items into an entree. While certainly not perfectly reflective of the price of the seafood in the entree's price, the retail price may prove to be a useful surrogate.

Secondly, the Poisson model of choice, which has been successful in explaining demand for outdoor recreation, provided results which were consistent with more anecdotal evidence about AFH demand for seafood. Besides the transparent linguistic connection with seafood, the model reflects the discrete nature of AFH decisions and the "rare" event nature of seafood consumption, especially when a particular species is being considered. We emphasize that species distinctions are critical in seafood because individuals perceive the differences and because government policies are often made on the basis of species. Aquaculturalists, too, must decide which species to grow.

Finally, the analyses provided information about the relative importance of price in determining demand for certain AFH and AH species. For low income households ($\approx$\$10,000), it appears that choice of AFH shellfish items is the most sensitive to price than AFH shellfish. At higher incomes ($\approx$\$30,000), the AH purchases of finfish becomes relative more sensitive to price. At very high incomes ($\approx$\$120,000), AFH choices appear nearly independent of price.

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