Consumer Expenditure Patterns for Fish and Shellfish

ORAL CAPPS, Jr.

Background

A successful seafood industry requires coordination between commercial fishermen and the ultimate consumers. The marketing system coordinates the production decisions of producers with the purchase decisions of consumers. Generally, this coordination is handled by middlemen, the seafood dealers and processors, since only a small part of the total production is sold directly to consumers by commercial fishermen.

This coordination, along with operations and investment planning, requires information on reliable measures of consumer expenditure patterns for fish and shellfish. Price and quantity changes at the consumer level provide signals to processors and commercial fishermen. Information on consumer expenditure for fishery products may lead to the development of processing and storage activities and facilities to increase market outlets. Market research programs are seriously restricted without information on factors affecting consumer expenditure on fishery products. Consumer expenditure information can also contribute to public decisions which will insure a more uniform flow of raw products to the processing sector.

The share of fish and shellfish expenditure relative to total red meat, poultry, and seafood expenditure has ranged from 5.3 percent to 8.2 percent over the past 30 years (Table 1). Over the same period,

Oral Capps, Jr., is Assistant Professor, Department of Agricultural Economics, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061. This work was sponsored by the Office of Sea Grant, NOAA, under Grant No. 5-29258 and the Virginia Sea Grant Program through Project No. R/SE-3.

ABSTRACT—This study investigates the nature and magnitude of the influence of price, household income, and socioeconomic and demographic variates on aggregate seafood expenditure in the United States. The analysis is based on expenditure patterns of nearly 10,000 households for the years 1972-74.

Socioeconomic and demographic characteristics included: 1) Geographic region, 2) population density, 3) household size, 4) race of household head, 5) marital status of household head, 6) education of household head, 7) occupation of household head, 8) industry of household head, 9) tenure class of household head, 10) seasonality, and 11) employment status of the female household head.

Geographic region, degree of population, density, race, marital status, and industry of the household head influence household expenditure on fish and shellfish. In addition, the price of fish and shellfish, household size, and household income are statistically significant factors in household expenditure on fish and shellfish. Increases (decreases) in price, household size, and household income lead to concomitant increases (decreases) in fish and shellfish expenditure. However, education, occupation, and tenure class of the household head as well as employment status of the female household head and seasonality do not significantly affect household expenditure on fish and shellfish.

Table 1.—Price, per capita consumption, and share of fish and shellfish expenditure relative to total red meat, poultry, and seafood expenditure (Economics and Statistics Service, 1981).

Year	Per capita fish/shellfish consumption (Pounds)	Consumer price index for fish/shellfish (1967 = 100)	Per capita total red meat/poultry/ seafood consumption (Pounds)	Consumer price index for total red meat/ poultry/seafood (1967 = 100)	Fish/shellfish expenditure share (%)
1950	11.8	73.1	162.3	85.5	6.2
1951	11.2	83.4	157.8	95.6	6.2
1952	11.2	81.3	165.2	94.7	5.8
1953	11.4	78.3	171.7	89.5	5.8
1954	11.2	78.7	171.5	88.0	5.8
1955	10.5	77.1	175.1	82.8	5.6
1956	10.4	77.0	180.7	79.1	5.6
1957	10.2	78.0	174.7	85.8	5.3
1958	10.6	83.4	171.6	93.9	5.5
1959	10.9	84.9	179.8	90.3	5.7
1960	10.3	85.0	178.4	89.1	5.5
1961	10.7	86.9	180.6	89.3	5.8
1962	10.6	90.5	181.9	91.5	5.8
1963	10.7	90.3	187.8	90.1	5.7
1964	10.5	88.2	191.8	88.7	5.4
1965	10.8	90.8	187.4	94.5	5.5
1966	10.9	96.7	193.1	102.6	5.3
1967	10.6	100.0	200.8	100.0	5.3
1968	11.0	101.6	204.5	102.2	5.3
1969	11.2	107.2	206.1	110.8	5.3
1970	11.8	117.8	211.7	116.5	5.6
1971	11.5	130.2	217.0	116.9	5.9
1972	12.5	141.9	216.9	128.0	6.4
1973	12.9	162.8	204.7	160.4	6.4
1974	12.2	187.7	214.7	163.9	6.5
1975	12.3	203.3	207.0	178.1	6.8
1976	13.1	227.3	221.0	179.4	7.5
1977	12.9	251.6	221.7	178.4	8.2
1978	13.6	275.4	219.7	208.3	8.2
1979	13.3	302.3	222.0	239.3	7.6
1980	13.5	328.6	226.7	247.9	7.9

the annual per capita consumption of fish and shellfish has trended gradually upward from 10.2 pounds to 13.6 pounds. Generally, consumer expenditure patterns depend upon prices, income, and socioeconomic and demographic characteristics. However, a paucity of information exists as to how such factors affect consumer expenditure for fish and shellfish.

Socioeconomic and demographic forces, particularly household size and age/sex composition, place of residence (region), and population density (degree of urbanization), may exert notable influences on fish and shellfish expenditure. This hypothesis is primarily attributable to shifts in the response of consumption to the life cycle, differences in accessibility of the products, differences in climate, and the development of consumer buying habits.

The age distribution of the U.S. population is in the process of change. Between 1970 and 1978, the number of persons 65 years of age and over rose at almost three times the rate of the rest of the U.S. population (Gallo et al., 1979). Single or two-person households are more commonplace, and the Census Bureau projects that over one-fourth of all U.S. households will consist of only a single person by 1990 (Sexauer and Mann, 1979). In addition, a number of studies of specific household expenditures indicate that race, education, occupation, industry, tenure class (home ownership), marital status, seasonality, and employment status of the female head are statistically important factors (Brown and Deaton, 1972; Ferber, 1973; Buse and Salathe, 1979). The impact of these socioeconomic and demographic characteristics is likely to reflect, in part, differences in tastes and preferences, culture, and infrastructure of households.

To enhance the understanding of fish and shellfish buying patterns in the United States, this study investigates the nature and magnitude of the influence of price, household income, and socioeconomic and demographic variates on aggregate seafood expenditure. The list of socioeconomic and demographic characteristics encompasses: 1) Geographic region, 2) population density, 3) household size, 4) race of household head, 5) marital status of household head, 6) education of household head, 7) occupation of household head, 8) industry of household head, 9) tenure class (homeownership) of household head, 10) seasonality, and 11) employment status of the female household head.

The aggregate fish and shellfish analysis is limited to this set of characteristics due to the unavailability of additional information. The source of data is the 1972-74 U.S. Bureau of Labor Statistics (BLS) Consumer Expenditure Diary Survey. This survey provides a comprehensive source of expenditure and income information in relation to socioeconomic and demographic characteristics of households in the United States (Capps et al., 1981). The source of price information is the Consumer Price Index for fish and shellfish.

Stolting et al. (1955), Purcell and Raunikar (1968), and Nash (1971) conducted research studies employing household survey data to investigate consumer expenditure patterns for fish and shellfish. This study builds on the foundation of the previous efforts by using more recent data and more sophisticated statistical techniques. A discussion of the data base and the statistical model is presented in subsequent sections. The fourth section deals with the results of the analysis. Concluding comments are given in the fifth section.

Data

The data source for this study is the 1972-74 BLS Consumer Expenditure Diary Survey. The survey covers the noninstitutional population of the United States in two samples of 12-month periods from June 1972 to June 1973 and July 1973 to June 1974. The time period is short enough so that consumer preferences are stable, yet long enough to accommodate the diversity of consumer choices. The sample for each survey year was partitioned into 52 weekly subsamples, to cover the entire calendar year and to expose seasonal variations in expenditure patterns. The first survey year included 11,065 households while the second survey year included 12,121 consumer units. Participants listed all expenditures during two consecutive 7-day periods, except for those while away from home overnight on trips or vacations.

All data were collected through the voluntary cooperation of households. Two separate collection vehicles served to obtain the data: 1) An interviewer-administered household characteristics questionnaire, and 2) a separate diary to record daily expenses over a 2-week period. The first type of collection vehicle recorded socioeconomic and demographic information pertaining to the household, and the second type of collection vehicle provided a self-reporting, product-oriented daily expense record. The diary questionnaire was divided by day of purchase and by broad classification of goods and services to aid the respondent when recording daily purchases and to facilitate the coding of individual purchases.

The sample used for this analysis includes nearly 10,000 households (roughly 40 percent of the BLS households participating in the Consumer Expenditure Diary Survey) that reported income and fish and shellfish expenditure information. For the sample, the mean and median 2-week expenditure for fish and shellfish is $2.81 and $1.72, respectively. The minimum expenditure is $0.03 and the maximum expenditure is $100.65. The mean and median percentage of total food expenditure for fish and shellfish is 4.04 and 2.61 percent, respectively. In contrast, the mean and median 2-week expenditure for total food is $81.28 and $72.47, respectively. The minimum expenditure for total food is $1.17 and the maximum expenditure is $697.76. In general, mean and median 2-week household expenditure as well as mean and median percentage of total food expenditure for fish and shellfish vary substantially across income levels and classifications of socioeconomic and demographic characteristics.[1]

Model

A variety of functional forms has been suggested to represent household expenditure behavior. All hypothesize that household expenditure is related to price, household income, and numerous so-

[1]For details, see Capps et al. (1981).

cioeconomic and demographic characteristics. The most widely used include the 1) linear, 2) quadratic, 3) double logarithmic, 4) semilogarithmic, 5) inverse, and 6) logarithmic-inverse functional forms (Prais and Houthakker, 1955; Goreaux, 1960; Leser, 1963; Brown and Deaton, 1972; Hassan and Johnson, 1977; Salathe, 1979; Smallwood and Blaylock, 1981). This study hypothesizes the quadratic function as the form of the aggregate fish and shellfish expenditure function.

The quadratic form possesses properties set forth by demand theory and may be thought of as a second-order Taylor series expansion in household income and household size to a general expenditure function (Howe, 1977). In addition, Salathe (1978) found that the quadratic form more accurately described expenditure behavior when comparing empirically alternative functional forms.

The mathematical form of the quadratic function used is:

$$\begin{aligned} FISH = {} & A_0 + A_1 GR2 + A_2 GR3 \\ & + A_3 GR4 + A_4 L2 + A_5 L3 \\ & + A_6 L4 + A_7 L5 + A_8 L6 \\ & + A_9 L7 + A_{10} L8 + A_{11} R1 \\ & + A_{12} M1 + A_{13} E1 + A_{14} E2 \\ & + A_{15} E3 + A_{16} E4 + A_{17} E5 \\ & + A_{18} OC1 + A_{19} OC2 + A_{20} OC3 \\ & + A_{21} OC4 + A_{22} OC5 + A_{23} OC6 \\ & + A_{24} OC7 + A_{25} OC8 + A_{26} OC9 \\ & + A_{27} I1 + A_{28} I2 + A_{29} I3 \\ & + A_{30} I4 + A_{31} I5 + A_{32} I6 \\ & + A_{33} I7 + A_{34} I8 + A_{35} H1 \\ & + A_{36} FH1 + A_{37} S1 + A_{38} S2 \\ & + A_{39} S3 + A_{40} PR \\ & + A_{41} FAMSIZE + A_{42} FSQ \\ & + A_{43} TOTLINC + A_{44} INSQ \\ & + A_{45} FSINC + e. \end{aligned} \quad (1)$$

The parameters $A_0, A_1, \ldots, A_{45}$ are the coefficients that measure the response of fish and shellfish expenditure to changes in price, household income, household size, and socioeconomic and demographic variates. The random variable e represents the stochastic disturbance term of the quadratic expenditure function. The independent variables $GR2$, $GR3$, $GR4$, $L2$, $L3$, $L4$, $L5$, $L6$, $L7$, $L8$, $R1$, $M1$, $E1$, $E2$, $E3$, $E4$, $E5$, $OC1$, $OC2$, $OC3$, $OC4$, $OC5$, $O6$, $O7$, $OC8$, $OC9$, $I1$, $I2$, $I3$, $I4$, $I5$, $I6$, $I7$, $I8$, $H1$, $FH1$, $S1$, $S2$, and $S3$ are binary or zero-one variables. Zero-one variables in this study take on the value of unity with the occurrence of a particular attribute and take on the value of zero with the nonoccurrence of a particular attribute. For example, when the variable $GR2$ is equal to one, this representation implies that the household is located in the North Central region of the United States. When the variable $GR2$ is equal to zero, this representation indicates that the household is located either in the Northeast, the South, or the West. The list of variable names is exhibited in Table 2.

Table 2.—List of variable names.

Item	
FISH	- Fish and shellfish expenditure
GR1	- Northeast region (omitted category)
GR2	- North Central region
GR3	- South region
GR4	- West region
L1	- SMSA's[1] 1,000,000+ population/central cities (omitted category)
L2	- SMSA's 1,000,000+ population/other than central cities
L3	- SMSA's 400,000 to 999,999 population/central cities
L4	- SMSA's 400,000 to 999,999 population/other than central cities
L5	- SMSA's 50,000 to 399,999 population/central cities
L6	- SMSA's 50,000 to 399,999 population/other than central cities
L7	- Outside SMSA's/urban
L8	- Outside SMSA's/rural
FAMSIZE	- Household size
R1	- White and other than Black
R2	- Black (omitted category)
M1	- Married
M2	- Widowed, divorced, separated, never married (omitted category)
E1	- Some grade school completed
E2	- Some high school completed
E3	- High school graduate
E4	- Some college completed
E5	- College graduate, graduate work
E6	- None (omitted category)
OC1	- Self-employed
OC2	- Salaried professional, technical worker
OC3	- Salaried managers, administrators
OC4	- Clerical
OC5	- Sales
OC6	- Craftsmen
OC7	- Operatives
OC8	- Unskilled laborers
OC9	- Retired
OC0	- Other (omitted category)
I1	- Agriculture, forestry, fishing, mining
I2	- Construction
I3	- Manufacturing
I4	- Transportation, communications, utilities, finance, insurance, real estate
I5	- Trade
I6	- Nonprofessional service
I7	- Professional service
I8	- Public administration
I0	- Other (omitted category)
TOTLINC	- Household income
H1	- Homeowner
H2	- Renter (omitted category)
FH1	- Employed female head
FH2	- Unemployed female head (omitted category)
S1	- Winter quarter
S2	- Spring quarter
S3	- Summer quarter
S4	- Fall quarter (omitted category)
PR	- Consumer price index of fish, shellfish
FSQ	- Family size squared
INSQ	- Total money income squared
FSINC	- Interaction of family size and income

[1]SMSA refers to Standard Metropolitan Statistical Area.

Most of the independent variables in the statistical model are zero-one variables. The key purpose of the use of zero-one variables is to achieve a greater degree of generalization in model formulation. The binary variables are intercept shifters, not slope shifters, of the quadratic expenditure function. The coefficients of the binary variables reflect the impact of region, population density, race of the household head, marital status of the household head, education of the household head, occupation of the household head, industry of the household head, tenure class of the household head, employment status of the female head, and seasonality on fish and shellfish expenditure.

When using zero-one variables, classifications of the socioeconomic and demographic variates have to be established so that they are mutually exclusive and exhaustive. The number of ones in each classification represents the number of replications. To handle the singularity problem (the sum of all zero-one variables of a particular socioeconomic and demographic variate forms a perfect linear association with the intercept of the statistical model), one of the zero-one variables of each set of classifications is arbitrarily deleted. Hence A_0, the intercept of the quadratic function, represents confounded components — some general intercept for the statistical model and the effects of omitted zero-one variables from each set of classifications of socioeconomic and demographic variates. Technically, A_0, is the base intercept of the expenditure function. The coefficients of the binary variables indicate the numerical amount by which the included classifications of the set of discrete variables differs from the base intercept.

Elasticities can be computed from (1) to summarize the influence of price, household size, and household income on fish and shellfish expenditure. The income elasticity measures the percent-

age change in fish and shellfish expenditure due to a 1 percent change in income. The income elasticity implied by (1) is given by:

$$\eta = (\partial FISH/\partial TOTLINC)\ (TOTLINC/FISH)$$
$$\eta = (A_{43} + 2A_{44}\ TOTLINC + A_{45}\ FAMSIZE)\ (TOTLINC/FISH), \quad (2)$$

where $(\partial FISH/\partial TOTLINC)$ is the partial derivative of *FISH* with respect to *TOTLINC*; (2) implies that the value of the income elasticity depends upon the expenditure level, income, and household size. A negative income elasticity indicates that expenditures on fish and shellfish decline (rise) as income increases (decreases). A positive income elasticity indicates that expenditures on fish and shellfish rise (decline) as income increases (decreases). The larger the magnitude of the income elasticity, the more responsive fish and shellfish expenditures are to changes in household income.

The household-size elasticity measures the percentage change in fish and shellfish expenditure due to a 1 percent change in household size. The household-size elasticity associated with (1) is given by:

$$\delta = (\partial FISH/\partial FAMSIZE)\ (FAMSIZE/FISH)$$
$$\delta = (A_{41} + 2A_{42}FAMSIZE + A_{45}TOTLINC)\ (FAMSIZE/FISH), \quad (3)$$

where $(\partial FISH/\partial FAMSIZE)$ is the partial derivative of *FISH* with respect to *FAMSIZE*; (3) implies that the value of the household-size elasticity depends upon the expenditure level, income, and household size. A positive (negative) household-size elasticity indicates that expenditures on fish and shellfish rise (decline) as household size increases. The larger the magnitude of the household-size elasticity, the more responsive fish and shellfish expenditures are to changes in household size.

The price elasticity of demand measures the percentage change in fish and shellfish consumption due to a 1 percent change in price. The price elasticity of demand associated with (1) is given by:

$$\epsilon = |(\partial FISH/\partial PR)\ (PR/FISH)| - 1$$
$$\epsilon = |(A_{40})\ (PR/FISH)| - 1, \quad (4)$$

where $(\partial FISH/\partial PR)$ is the partial derivative of *FISH* with respect to *PR*; (4) implies that the value of the price elasticity of demand depends upon the expenditure level and the price level. A positive value of A_{40} indicates that the demand for fish and shellfish is inelastic. Increases (decreases) in fish and shellfish price lead to concomitant increases (decreases) in fish and shellfish expenditure. A negative value of A_{40} indicates that the demand for fish and shellfish is elastic. Increases (decreases) in fish and shellfish price lead to concomitant decreases (increases) in fish and shellfish expenditure. The larger the magnitude of the price elasticity, the more responsive fish and shellfish expenditures are to changes in price. The sample means of *FISH*, *TOTLINC*, *FAMSIZE*, and *PR* are used in this study for calculating the price, income, and household-size elasticities.

Since both zero-one and continuous quantitative variables are components of the quadratic model, this formulation is, technically speaking, a multiple covariance model. Analysis of covariance is the combination or the blending of multiple regression and analysis of variance. The covariates in this study are price, household size, and household income.

Results

The estimation of the coefficients of the quadratic expenditure function was accomplished through the use of ordinary least squares. The regression analysis for the quadratic functional form is exhibited in Table 3. The Durbin-Watson D statistic indicates the absence of autocorrelation in the disturbance term of the statistical model. Slightly more than 5 percent of the variation in household expenditure on fish and shellfish is accounted for by the set of regressors in the quadratic expenditure model. Although not shown due to space limitations, the matrix of correlation coefficients for regressors in the quadratic expenditure function indicates the absence of multicollinearity problems.

The estimated coefficients of the zero-one variables represent incremental differences relative to the base intercept. Tests of hypotheses about the individual parameters of the zero-one variables provide information about whether the intercepts for each of the included classifications of discrete variables are different from the omitted classifications.

The *t*-test is used to perform tests of significance about the estimated coefficients of binary variables and about the estimated coefficients of continuous quantitative variables. To test hypotheses about all possible pairs of differences among the parameters of the zero-one variables within particular socio-

Table 3.—Regression analysis for the quadratic expenditure function.

Variable	Parameter estimate	Standard error	*T*-ratio	*P*-value
INTERCEPT	1.801036	0.641712	2.8066	0.0050
GR2	-0.912618	0.108785	-8.3892	0.0001
GR3	-0.515220	0.108005	-4.7704	0.0001
GR4	-0.360134	0.116227	-3.0986	0.0020
L2	-0.699891	0.117210	-5.9713	0.0001
L3	-0.539719	0.181428	-2.9748	0.0029
L4	-0.620412	0.178563	-3.4745	0.0005
L5	-0.948617	0.171233	-5.5399	0.0001
L6	-0.745032	0.172914	-4.3087	0.0001
L7	-0.600488	0.143214	-4.1929	0.0001
L8	-0.783947	0.142787	-5.4903	0.0001
FAMSIZE	-0.320238	0.085181	3.7595	0.0002
R1	-0.768427	0.137179	-5.6016	0.0001
M1	-0.308821	0.125770	2.4554	0.0141
E1	-0.231905	0.402680	-0.5759	0.5647
E2	-0.239230	0.407235	-0.5875	0.5569
E3	-0.257692	0.403787	-0.6382	0.5234
E4	-0.355718	0.411748	-0.8639	0.3877
E5	-0.251917	0.415902	-0.6057	0.5447
OC1	0.370868	0.331973	-1.1172	0.2640
OC2	0.328923	0.304975	-1.0785	0.2808
OC3	0.461138	0.309447	1.4902	0.1362
OC4	0.355045	0.309821	1.1460	0.2518
OC5	0.235168	0.350053	0.6718	0.5017
OC6	0.229753	0.303300	0.7575	0.4488
OC7	0.209574	0.306458	0.6839	0.4941
OC8	0.381418	0.298858	1.2763	0.2019
OC9	0.033657	0.204221	0.1648	0.8691
I1	-0.714158	0.400294	-1.7841	0.0744
I2	-0.564825	0.364551	-1.5494	0.1213
I3	-0.737871	0.342395	-2.1550	0.0312
I4	-0.579322	0.351637	-1.6475	0.0995
I5	-0.481109	0.351257	-1.3697	0.1708
I6	-0.458026	0.368792	-1.2420	0.2143
I7	-0.371113	0.353738	-1.0491	0.2942
I8	-0.277728	0.320480	-0.8666	0.3862
TOTLINC	.00004958735	0.0000118872	4.1715	0.0001
H1	0.062107	0.089856	0.6912	0.4895
FH1	-0.132897	0.091600	-1.4508	0.1469
S1	0.104934	0.105613	0.9936	0.3205
S2	0.126396	0.109415	1.1552	0.2480
S3	0.043687	0.108251	0.4036	0.6865
PR	0.902193	0.264031	3.4170	0.0006
FSQ	-0.00889571	0.00873766	-1.0818	0.3087
INSQ	2.90141E-10	8.65610E-11	3.3519	0.0008
FSINC	-.0000056173	.00000256571	-2.1894	0.0286

SSE	118734	*F* ratio	11.13
DFE	9020	*P*-value	0.0001
MSE	13.163413	*R*-squared	0.0526

Durbin-Watson D statistic = 1.9535
First order autocorrelation coefficient = 0.0232
Source: Computations by the author

economic and demographic classifications, the Newman-Keuls procedure is used. The Newman-Keuls test, a sequential range test, is designed to overcome the problem of the changing level of significance when conventional statistical tests for ascertaining differences among pairs of parameters are applied to sets of nonorthogonal differences[2]. The basic notion underlying this test is that the ranges of differences specified as significant at a chosen level of significance are systematically adjusted depending upon the number of coefficients in the particular classifications so as to offset the loss of the level of significance[3].

The *P*-value summarizes what the data say about the credibility of the null hypothesis H_O: $A_i = O$, $i=1, 2, \ldots, 45$ for the quadratic expenditure model. The null hypothesis is rejected if the *P*-value is less than the specified level of significance. The significance level chosen for this research study is 0.10.

Households located in the Northeast purchase significantly more fish and shellfish than households located in the North Central region, the South, and the West. In addition, households located in the South and the West spend significantly more on fish and shellfish than households located in the North Central region. No statistically significant differences exist in fish and shellfish expenditure patterns between households in the South and in the West. Further, households located in Standard Metropolitan Statistical Areas (SMSA's) with 1,000,000 or more population spend significantly more on fish and shellfish than households located in less densely populated areas. Fish and shelfish expenditure for households located in SMSA's with 400,000 to 999,999 population, SMSA's with 50,000 to 399,999 population, and urban and rural areas outside SMSA's is statistically the same.

Household heads in agriculture, forestry, fishing, mining, construction, manufacturing, transportation, communications, utilities, finance, insurance, and real estate industries expend significantly less on fish and shellfish than household heads in other industries. All other differences in fish and shellfish expenditure among industries of household heads are statistically nonsignificant. Education of the household head, occupation of the household head, tenure class of the household head, employment status of the female head outside the home, and seasonality are not statistically important factors in explaining the variation in household expenditure on fish and shellfish. Blacks and married persons, however, expend significantly more on fishery products than nonblacks and nonmarried persons.

In sum, test of significance indicate that geographic region, population density, race, marital status, and industry of the household head influence household expenditure on fish and shellfish. On the other hand, education, occupation, employment status of the female head outside the home, tenure class of the household head, and seasonality do not significantly affect household expenditure on fish and shellfish.

The price of fish and shellfish, household size, and household income are statistically significant factors in household expenditure on fish and shellfish. In the quadratic expenditure model, increases (decreases) in price, household size, and household income lead to concomitant increases (decreases) in household expenditure on fish and shellfish. A 10 percent change in household income is positively associated with a 1.68 percent change in aggregate fish and shellfish expenditure. This measure indicates that fish and shellfish is a normal good. Similarly, a 10 percent change in household size is positively associated with a 2.30 percent change in aggregate fish and shellfish expenditure. The price elasticity of demand for fish and shellfish is inelastic. A 10 percent change in price leads to a 4.67 percent change in fish and shellfish consumption in the opposite direction. On the basis of the estimated coefficients of price in the statistical model, a 10 percent increase (decrease) in the price of fish and shellfish leads to a 5.32 percent increase (decrease) in fish and shellfish expenditure.

The estimated quadratic expenditure model may be used to make predictions of 2-week household expenditure on fish and shellfish given information on price, household income, household size, and socioeconomic and demographic characteristics. Various socioeconomic and demographic profiles can be constructed to examine household expenditure behavior. To illustrate, two profiles of 2-week household expenditure on fish and shellfish by household income and household size are presented in Tables 4 and 5.

The first profile incorporates the following socioeconomic and demographic characteristics: 1) The household is located in the Northeast, 2) the household is located in a central city within a SMSA of 1,000,000 and over population, 3) the household head is black, 4) the head of

[2]The basic problem with testing all possible pairs is that the level of significance decreases as the number of nonorthogonal comparisons increases. One may be performing tests of hypotheses at some chosen level of significance when in fact the true level of significance may be considerably less. The outcome is that too many differences are judged to be statistically significant at a chosen significance level.

[3]For the presentation of pairwise comparisons for estimated coefficients of the statistical model by socioeconomic and demographic variates based on the Newman-Keuls test, see Capps et al. (1981).

Table 4.—Profile 1: Predictions of 2-week household expenditure by household income and by household size.[1]

Household income	Household size (no. of members)				
	One	Two	Three	Four	Five
$ 2,000	$4.47	$4.75	$5.02	$5.27	$5.49
$ 5,000	$4.61	$4.88	$5.12	$5.35	$5.57
$10,000	$4.85	$5.09	$5.31	$5.51	$5.69
$15,000	$5.11	$5.32	$5.51	$5.68	$5.84
$20,000	$5.38	$5.56	$5.72	$5.87	$6.00
$25,000	$5.66	$5.82	$5.95	$6.07	$6.17
$35,000	$6.28	$6.37	$6.45	$6 51	$6.56
$50,000	$7.31	$7.32	$7.31	$7.29	$7.25

[1]Source: Computations by the author

Table 5.—Profile 2: Predictions of 2-week household expenditure by household income and by household size.[1]

Household income	Household size (no. of members)				
	One	Two	Three	Four	Five
$ 2,000	$2.54	$2.82	$3.09	$3.34	$3.56
$ 5,000	$2.68	$2.95	$3.19	$3.42	$3.64
$10,000	$2.92	$3.16	$3.38	$3.58	$3.76
$15,000	$3.18	$3.39	$3.58	$3.75	$3.91
$20,000	$3.45	$3.63	$3.79	$3.94	$4.07
$25,000	$3.73	$3.89	$4.02	$4.14	$4.24
$35,000	$4.35	$4.44	$4.52	$4.58	$4.63
$50,000	$5.38	$5.39	$5.38	$5.36	$5.32

[1]Source: Computations by the author

the household is separated, 5) the household head is a high school graduate, 6) the household head is self-employed, 7) the household head is in the construction business, 8) the household head is a renter, 9) the female household head is unemployed and 10) the season is the fall quarter. The second profile embodies the following socioeconomic and demographic characteristics: 1) The household is located in the South, 2) the household is located in a rural area outside a SMSA, 3) the household head is white, 4) the household head is married, 5) the household head has completed some high school, 6) the household head is an unskilled laborer, 7) the household head is in the manufacturing business, 8) the household head is a homeowner, 9) the female household head is employed, and 10) the season is the summer quarter. The price used for the arrangement of these profiles is the annual average Consumer Price Index of fish and shellfish for 1979 (3.023).

For example, a household with an annual income of $20,000 and five family members that fits the specification of the first profile would spend $6.00 biweekly for fish and shellfish. Similarly, a household with the same annual income and family size that fits the specification of the second profile would spend $4.07 biweekly for fish and shellfish. In general, for any socioeconomic and demographic profile, as household size increases (decreases) ceteris paribus, or as household income increases (decreases) ceteris paribus, the expenditure on fish and shellfish also increases (decreases). The tremendous wealth of detail in the classifications of the socioeconomic and demographic variates permits the construction of 1,105,920 unique profiles of the type in Tables 4 and 5. The reader is left to pursue those which are of the most interest to him. Such profiles are useful for market research programs by the seafood industry.

Concluding Comments

A logical generalization is to extend the analysis to focus on individual fish and shellfish species such as hard blue crabs, oysters, clams, and food finfish. A second generalization involves the examination of the impact of additional socioeconomic and demographic characteristics such as religion and age-sex composition of the household on fish and shellfish expenditure. A third generalization encompasses the use of the 1977-78 Nationwide Food Consumption Survey. A comparison of household expenditure patterns of fish and shellfish from the 1972-74 Consumer Expenditure Diary Survey and from the 1977-78 Nationwide Food Consumption Survey provides indications of stability or instability of consumer behavior in the seafood market. The last decade was characterized by dramatic changes in price, household income, and socioeconomic and demographic characteristics. Additional studies of household expenditure behavior are likely to pay dividends to the seafood industry.

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